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21. FORMATION MICROSCANNER LOGGING RESPONSES TO LITHOLOGY IN GUYOT CARBONATE PLATFORMS AND THEIR IMPLICATIONS: SITES 865 AND 866[1]

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ABSTRACT

Formation MicroScanner (FMS) images from Sites 865 and 866, Allison and Resolution guyots, respectively, were integrated with conventional logging data and core descriptions to provide detailed stratigraphic columns for those sites. First, large-scale (in hundreds of meters) lithologic units were determined from the conventional logs and compared to core descriptions; these units typically contain several major carbonate facies. Second, a "type" facies log response was established for each carbonate facies by correlating the best FMS images with the conventional log response and core information for the same depth. Finally, the remaining portions of the FMS images were interpreted using the "type" facies log responses as standards of comparison. It was immediately apparent that core recovery at both sites was highly preferential (e.g., within the alternating packstone-wackestone intervals, only small pebbles of well-cemented wackestone were recovered). This study indicated that packstone was the dominant lithology (51%) at Hole 865A and that grainstone (25%) and packstone (20%) were the dominant lithologies at Hole 866A (excluding dolomite).

The sedimentary record, as determined from core-log integration, not only confirmed shipboard conclusions regarding the gross vertical trajectories of Allison and Resolution guyots, but provided details of facies changes that resulted from small-scale fluctuations in sea level. Deposition of the Albian section of Resolution Guyot overlaps in time with deposition of sediments at Allison Guyot. This study supports Strasser's conclusion (this volume) that a hiatus probably exists near the Albian/Aptian boundary at Resolution Guyot. Correlations of bed thicknesses and logging signatures between the two holes indicates that much of the Albian section may have been removed from Allison Guyot as it emerged above sea level.

INTRODUCTION

The central and northwestern Pacific Ocean seafloor is festooned with platforms and chains or groupings of seamounts, many of which are Cretaceous guyots, with their summits at depths of about 1500 m (Menard, 1964; Matthews et al., 1974; Winterer and Metzler, 1984; McNutt et al., 1990). Many of the volcanic edifices of the guyots are capped by shallow-water carbonate sediments. The sediments, which are almost always deposited at or near sea level, record the vertical trajectory of these guyots relative to sea level, caused by subsidence or uplift as well as fluctuations in eustatic sea level. The main scientific theme of the Leg 143 drilling program was the origin and evolution of Cretaceous guyots and their relationship to sea level. Thick deposits of carbonate platform sediments were sampled at Sites 865 and 866, located in the lagoons of two drowned carbonate platforms in the Mid-Pacific Mountains, Allison and Resolution, respectively (Fig. 1).

The formation of thick carbonate deposits requires a dynamic equilibrium between carbonate deposition and subsidence. The added dimension of time leads to the development of stratigraphic sequences that reflect changes in the depositional style. Variables affecting the style of deposition include changes in sea level, sedimentation rates, type of facies at the platform margin, and tectonic activity. A continuous vertical record of the stratigraphic sequence is necessary to determine the history of the relative influences of these variables on deposition at a particular site. For that reason, the stratigraphic record is usually the primary objective of scientific drilling, but is the most difficult to obtain when using rotary (RCB) drilling in reefal carbonates. Indeed, mean core recovery at Sites 865 and 866 was less than 16% and only 1% to 2% in the shallow-water limestones. Thus, logs are particularly important at those sites to address the primary objectives of the drilling (Shipboard Scientific Party, 1993). Downhole logs provide the essential addition of a continuous time-series measurement of the physical properties of the borehole wall. The purpose of this study is to integrate the conventional logging data, FMS images, and core information to provide detailed stratigraphic information that can constrain the vertical trajectories of the guyots, allowing one to correlate directly with other guyots drilled during Legs 143 and 144.

DESCRIPTION AND INTERPRETATION OF FMS LOGS

Logging Program at Sites 865 and 866

Ocean Drilling Program (ODP) Leg 143 obtained an extensive suite of in-situ borehole logging measurements (Sager, Winterer, Firth, et al., 1993). Hole 865A (Fig. 1), which penetrated 870.9 m of calcareous oozes, wackestones and packstones, and basalts at Allison Guyot, was the only hole logged at Site 865; good logs were obtained within the open borehole between 100.5 and 867.0 mbsf. Five tool strings were run, including the sonic-porosity-density-gamma, the resistivity-gamma, the geochemical tool string, the Japanese downhole magnetometer, and the Formation MicroScanner (FMS). Descriptions of the tools and their data characteristics are found in Shipboard Scientific Party (1993). The same five tool strings were run in Hole 866A at Resolution Guyot (Fig. 1) to cover the interval 74.5 to 1679.4 mbsf for the first run only. Subsequent runs concluded at shallower depths because of cave-ins above 1679.4 mbsf, and the FMS was not run above 253.0 mbsf because of the extremely large hole size (>17.2 in. or 43.7 cm).

In both holes, cycle skipping and other noise resulting from inadequate centralization of the tool compromised the quality of the sonic logs; hence, these were not used extensively for this analysis. Because of its mechanical problems, no valid data were recorded by the geochemical tool at either hole. Large hole diameters over 20- to 35-m

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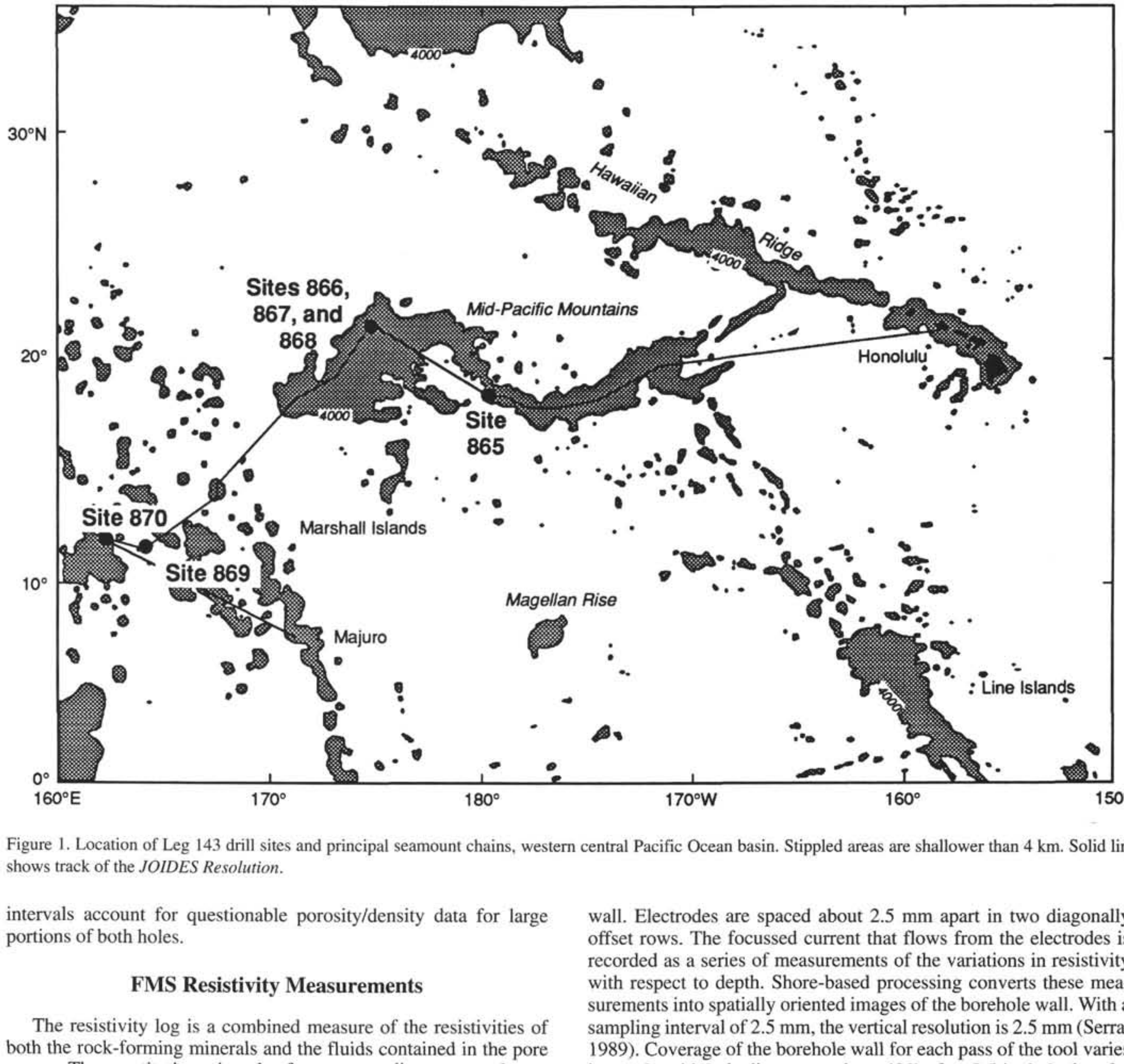


Figure 1. Location of Leg 143 drill sites and principal seamount chains, western central Pacific Ocean basin. Stippled areas are shallower than 4 km. Solid line shows track of the *JOIDES Resolution*.

intervals account for questionable porosity/density data for large portions of both holes.

FMS Resistivity Measurements

The resistivity log is a combined measure of the resistivities of both the rock-forming minerals and the fluids contained in the pore spaces. The constitutive minerals of common sedimentary rocks are highly resistive; hence, water content and salinity are the two most important factors that control measured electrical resistivity. Other factors that can influence resistivity include the concentration of hydrous and metallic minerals, vesicularity, the geometry of interconnected pore spaces, and, to a lesser extent, temperature. Research has shown that, to a first-order approximation, resistivity is proportional to the inverse square root of the porosity (Archie, 1942).

In pure limestones, electrical current is conducted almost entirely by the brine contained in the pore space. High resistivities correspond to low porosities; low resistivities correspond to high porosities. Wet clays conduct electricity, and the magnitude of this conduction effect in clayey limestones will depend on the percentage of clay content and clay mineral composition (Archie, 1952).

The FMS produces high-resolution resistivity measurements of the borehole wall (Ekstrom et al., 1987) that are ideal for detailed sedimentological studies (e.g., Bourke et al., 1989; Adams et al., 1990; Luthi, 1990; Harker et al., 1990). The tool consists of 16 electrodes on each of four orthogonal pads that press against the borehole wall. Electrodes are spaced about 2.5 mm apart in two diagonally offset rows. The focussed current that flows from the electrodes is recorded as a series of measurements of the variations in resistivity with respect to depth. Shore-based processing converts these measurements into spatially oriented images of the borehole wall. With a sampling interval of 2.5 mm, the vertical resolution is 2.5 mm (Serra, 1989). Coverage of the borehole wall for each pass of the tool varies inversely with hole diameter—about 40% of an 8.5-in. hole, less for greater diameters. Perhaps the most important limitation of the tool is the restriction to hole diameters of less than 38.1 cm (15 in.). Some information may be gleaned from the image if one or two pads make good contact with the borehole wall, as is the case with highly elliptical holes, but often no useful information is contained in FMS images from washed out sections.

The resistivity values of the surfaces sampled by the pads are converted to gray scale and plotted as a set of vertical strips with an indication of pad orientation. This oriented image (Figs. 2–7) corresponds to an unrolled cylinder with a width that is equivalent to the diameter of the borehole. Horizontal and vertical scales are the same. In general, low resistivities (high conductivities) are shown as dark tones, whereas high resistivities (low conductivities) are shown as light tones. The image tone is a qualitative representation of electrical resistivity because, when processing the data, normalization procedures are applied to optimize the contrast on the images. Images are usually interpreted with the aid of conventional resistivity logs to quantify the variation of electrical resistivity within the formation.

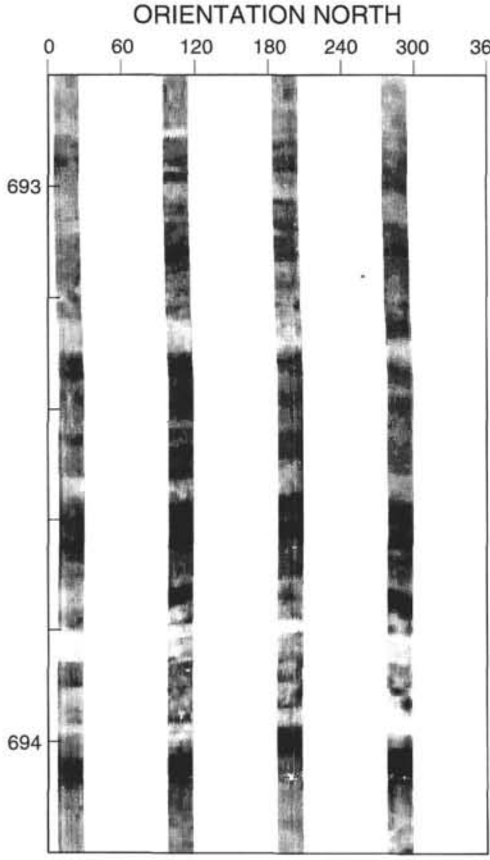


Figure 2. FMS image from 692.8 to 694.2 mbsf, Hole 866A, interpreted as grainstone texture showing intervals of greater (light) and lesser (dark) cementation. Dark spots are molds or vugs.

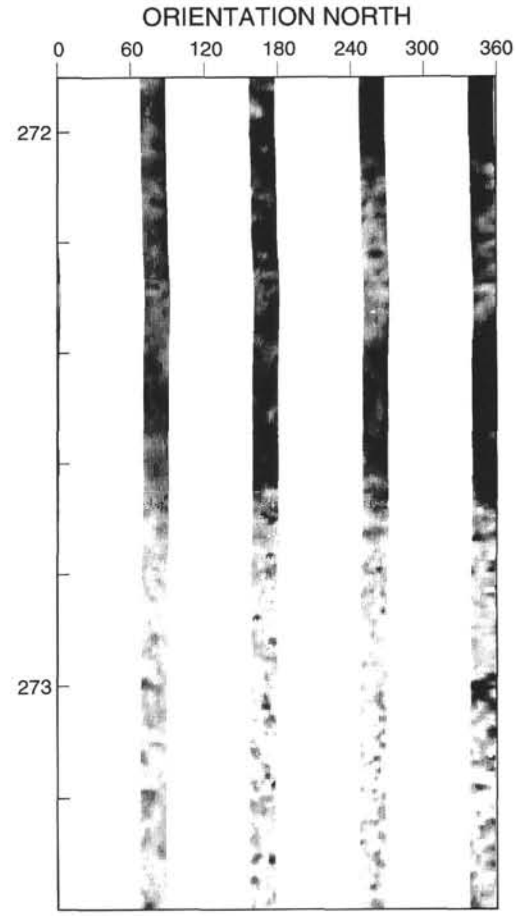


Figure 3. This FMS image from 271.9 to 273.4 mbsf, Hole 866A, interpreted as a packstone (top)–wackestone (bottom) texture, presents a mottled appearance with irregular white spots on an irregular dark gray background. Dark spots are molds or vugs.

Methodology for Integration of Conventional Logging Data, FMS Images, and Core Data

Integration of the FMS, conventional logs, and cores proceeded in the following way: First, conventional resistivity, velocity, porosity, density, gamma, and caliper logs were plotted together for 100-m intervals. This multiple-trace presentation facilitated determination of large-scale trends and patterns. The major sedimentary units were identified on the basis of baseline shifts or similar variability, mainly in the resistivity and natural gamma-ray logs (see Shipboard Scientific Party, 1993). These major sedimentary units then were identified in the FMS images.

To do this, the FMS logs were depth-matched to the conventional logs by correlating the gamma-ray logs between runs. A linear depth shift was applied to all logs to correct for differences in the stretch of the logging cable, using the gamma log from the first logging run as reference. These depths should be accurate to within ±2 m of the drillers' depths. All logging depths (recorded as feet below rig floor) were then corrected to meters below seafloor by subtracting the depth from the rig floor to the seafloor. Short, repeat sections of the FMS for both holes were compared to differentiate between geologic reality and processing artifact.

Second, the identification of a "type" log facies for each recovered core facies was accomplished by intercomparison of FMS, conventional logs, and core descriptions. The FMS and conventional logs were displayed and inspected simultaneously to identify conventional log responses that corresponded to characteristic patterns observed on the FMS image. Long (>10 m) FMS and conventional logging sections with reasonably uniform characteristics were then compared to descriptions of core material taken from the same depth range. Special care was exercised because core recovery was poor and obviously preferential; typically, within the alternating packstone-wackestone intervals, only small pebbles of the well-cemented wackestones were recovered. However, we reasoned that if the logging responses were similar over a given depth interval and only one lithology was recovered over that interval, then we could be certain that our interlog correlation as a "type" facies was accurate. The classification of shallow-water carbonate textures used here is the same as that used in Sager, Winterer, Firth, et al. (1993), namely, that of Dunham (1962). Fortunately, the thick sections of wackestone-packstones and grainstones provided multiple "type" facies that could be checked against each other. The remaining portions of the FMS logs were interpreted by comparison to the "type" facies logging responses.

The greatest source of error in the identification of facies in the FMS images was hole size. Hole diameters for more than two-thirds of Hole 865A and one-third of Hole 866A were larger than the maximum opening diameter (38.1 cm) of the FMS calipers. The FMS data were of poor quality for the depth intervals 102–145, 198–212, 248–296, 305–322, 373–440, 500–527, 565–638, 651–702, and 746–791 in Hole 865A, and 200–262, 375–390, 455–661, 802–825, 976–993, 1037–1054, 1078–1106, 1124–1152, 1278–1292, and 1317–1340 in Hole 866A. Poor pad contact in these portions of the hole degraded the quality of the images. On some images two, sometimes only one, pads made good contact with the borehole wall; nonetheless, the images could still be interpreted based on comparisons to the type log facies. The conventional logs did not require contact with the borehole wall; corrections for the effects of variations in hole size were applied in post-cruise data processing.

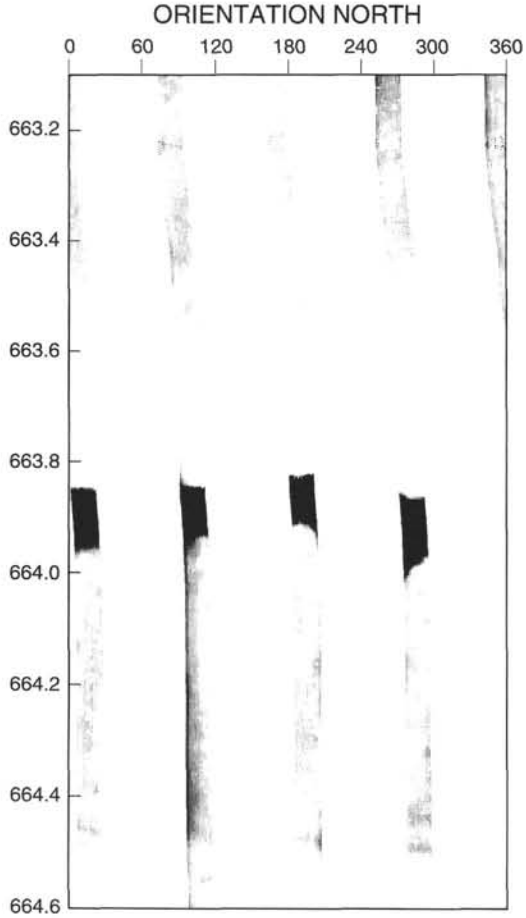


Figure 4. FMS image from 663.1 to 664.6 mbsf, Hole 866A. A mudstone presents a relatively homogeneous white to light gray image, depending on the porosity (the lower the porosity, the whiter the image). The black band above 664.0 mbsf is a clay seam.

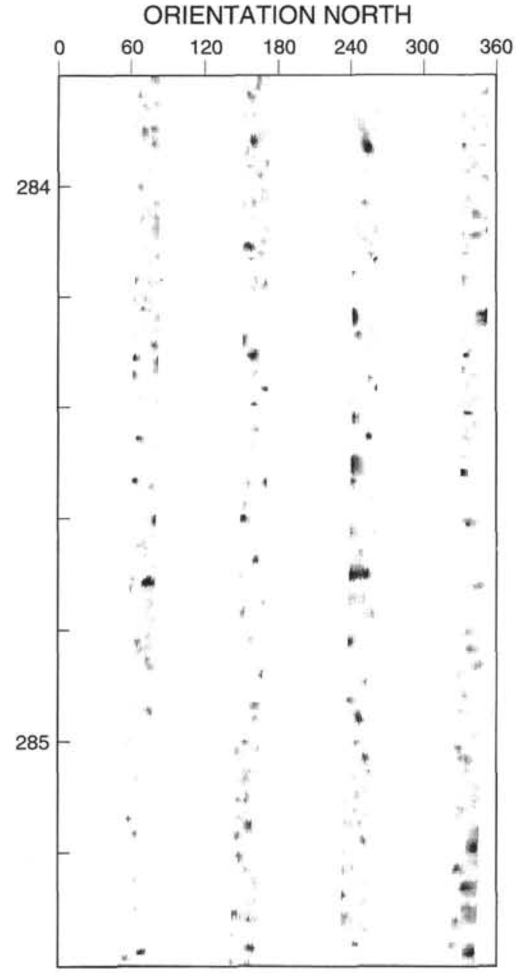


Figure 5. FMS image from 283.8 to 285.4 mbsf, Hole 866A. Images of mudstones with extreme moldic porosity closely resemble those of wackestone; the two textures can be distinguished only by their relative densities.

FMS IMAGE INTERPRETATIONS

Keeping in mind that the image tone is not directly proportional to the resistivity value, the dark tones of the FMS image usually correspond to materials that are conductive because of high intergranular porosity, fine-grained textures, or the presence of conductive minerals (e.g., clay and pyrite). The light tones correspond to materials that are resistive, either because of low intergranular porosity (e.g., mudstones) or coarse-grained texture (Serra, 1989). Identification of lithology was sometimes clear and straightforward, sometimes intuitive. For example, thick (>1 cm) organic- and clay-rich facies were easily identifiable in the FMS image as sharply defined black bands and in conventional logs, as a sharp, low-resistivity peak corresponding to a high-gamma peak. Thin layers or disseminated clay and organic-rich matter (as reported in the core descriptions) produced subtle logging responses that would have been difficult to interpret without calibration by the core material. Some minor lithologies, notably boundstone, were difficult to identify accurately in the FMS images because these produced no characteristic logging response aside from low density values, which are common to several carbonate textures. Combining the core descriptions with boundstone texture described by Serra (1989), we concluded that the boundstone texture was characterized by irregular, dark features (molds) in a gray background with white, somewhat vertical, interconnecting features that would result from the continuous, cemented framework, and with white spots or streaks (shell fragments).

Grainstone texture was characterized by obvious layering (Fig. 2); individual layers having a constant gray tone corresponded to well-sorted intervals. Packstones and wackestones presented a mottled appearance as a result of their highly variable grain sizes and porosities, with irregular white spots on an irregular gray background, sometimes with dark spots (molds or vugs). Wackestones (Fig. 3, bottom portion) contain more lime mud than do packstones (Fig. 3, top portion) and therefore are more resistive. Mudstones produced a relatively homogeneous white to light gray tone depending on the porosity (Fig. 4). Images of mudstone having extensive moldic porosity (Fig. 5) closely resembled packstone-wackestone, but could be distinguished on the basis of relatively higher density in the conventional logs. Rudstone texture is characterized by irregular white spots (packstone-wackestone) isolated in a dark background and in the conventional logs by low density, resistivity, and sonic velocity. Dolomite often displays a texture similar to rudstone: leached and moldic porosities combine to present a dark background (Fig. 6), but much higher resistivity values in the conventional log. Partial dolomitization is indicated in the FMS image by dark areas that correspond to zones of higher porosity that may cross bedding planes (e.g., in the grainstones, Fig. 7).

Figure 8 provides a key to patterns that indicate carbonate textures in Figures 9 and 10. Figures 9 and 10 display the conventional logs most important for interpreting the FMS images, including resistivity, gamma-ray, density, and caliper, the core number and amount recovered, together with interpretation of the lithology. The pattern indicates

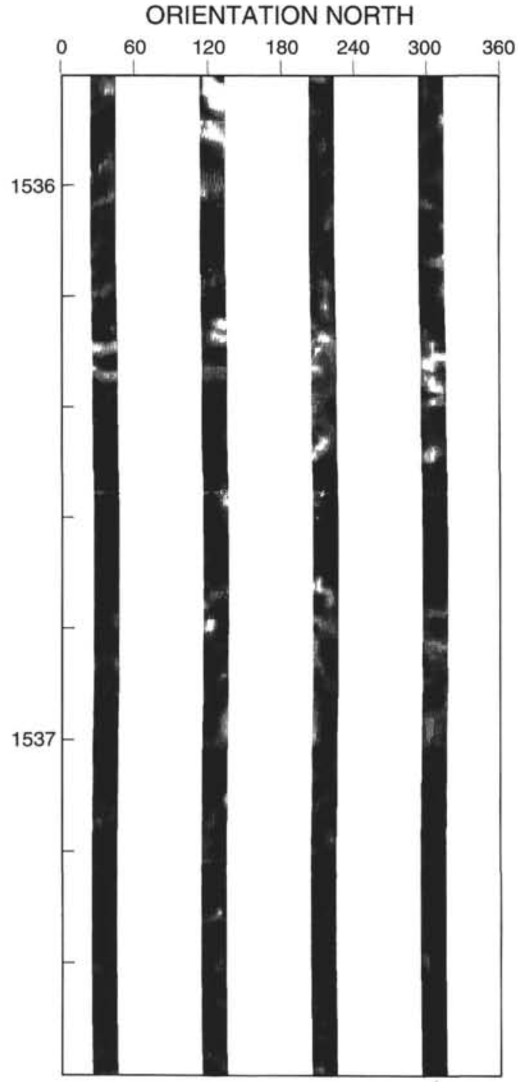


Figure 6. FMS image from 1535.8 to 1537.6 mbsf, Hole 866A. Dolomites typically display a rudstone texture (i.e., irregular white spots [dense, redeposited carbonate]) in an irregular, dark gray to black background (leached and moldic porosities).

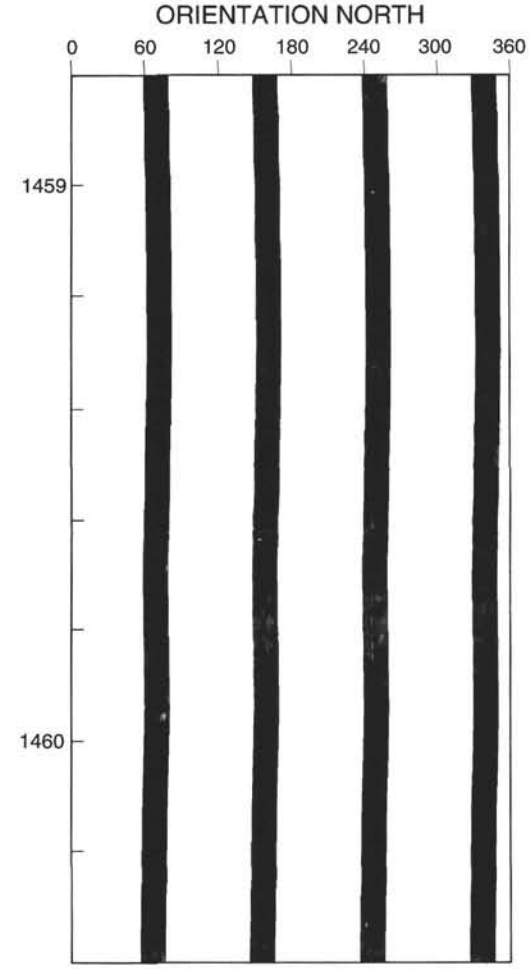


Figure 7. FMS image from 1458.8 to 1460.4 mbsf, Hole 866A. Dolomitization occurs preferentially within the most porous facies, the grainstones. In this example, some grainstone texture remains, although dark areas, corresponding to zones of higher porosity, cut across bedding planes.

the dominant lithology for an interval; in some cases, a split pattern is shown to indicate almost equal interbeds of another lithology. Split patterns also are used to indicate partial dolomitization or a dolomitized section having relict texture. Because of the limited range of black- and-white patterns and shadings available, more detailed descriptions of the facies are listed in Tables 1 (Hole 865A) and 2 (Hole 866A). Occasionally, the core material was matched to the FMS images on the basis of such distinctive characteristics as size and amount of moldic porosity, presence of stylolites or clay seams, among others. Core numbers are placed in the comment section of the bed or beds from which they may have originated. In many cases, especially in the thin packstone-wackestone interbeds, it was not possible to identify the place of origin of the core material with confidence.

EFFECTS OF LITHOLOGY ON CORING

Overall recovery in both holes was poor, averaging only about 2% in the shallow-water limestones, despite repeated efforts to improve recovery by changing the style of coring. Instead of smoothly cut core, hard, shelly wackestone was recovered as small chunks with typical dimensions of 1 to 4 cm. These hard limestone layers constitute thin, scattered layers; the bulk of the sediment consists of limestones too porous or weakly cemented to core using the available tools. In intervals where variations in cementation were present, lower resistivity and density values directly corresponded to large hole diameters; soft, poorly indurated material was preferentially removed during the drilling process. Recovery was lowest in strata having intergranular and extreme moldic porosity (packstones and grainstones) and highest in clay-rich or dolomitized strata. For example, as clay content and dolomitization increased downhole at Site 866 from about 600 mbsf, recovery increased to about 50% in the lowest 50 m of the hole.

The FMS log reveals more well-cemented intervals than were recovered as core. Recovery in wackestone-packstone (hard-soft) intervals having thicknesses on the order of 1 to 2 m was particularly poor. In some cored intervals, it was possible to locate the recovered material at its source depth (Tables 1 and 2); a pattern of recovery is suggested such that when coring begins or ends in a well-lithified layer, some of that layer is usually recovered.

Table 3 summarizes the statistical distribution of lithologies interpreted from the core-log integration at Holes 865A and 866A. All beds containing predominantly grainstone (e.g., grainstone-packstone, grainstone-rudstone) were grouped under grainstone; similarly, all beds containing predominantly rudstone (e.g., rudstone-packstone,

Table 1. Description of beds at Hole 865A (Allison Guyot).

Bed number	Depth range (mbsf)	Lithology	Description
1	135.0–140.0	Foraminifer-nannofossil ooze	Subtly mottled
2	140.0–143.31	Packstone	
3	143.31–143.76	Wackestone	Moldic porosity
4	143.76–146.13	Packstone	
5	146.13–147.25	Wackestone	Moldic porosity
6	147.25–149.93	Packstone-wackestone	Moldic porosity; minor floatstone (148.2–148.4) (Core 18R)
7	149.93–152.05	Wackestone-packstone	Moldic porosity
8	152.05–155.40	Packstone	Moldic porosity
9	155.40–156.59	Wackestone	Moldic porosity
10	156.59–157.39	Packstone	
11	157.39–158.27	Packstone-wackestone	
12	158.27–158.84	Packstone	Uniform grain size
13	158.84–159.24	Wackestone	
14	159.24–160.96	Packstone	Minor moldic porosity; minor wackestone intervals
15	160.96–167.70	Packstone-wackestone	Moldic porosity concentrated at distinct horizons; well-cemented intervals (mudstone?)
16	167.70–180.92	Packstone	Highly porous and vugular; wackestone intervals (167.6–167.8, 172.2–173.2); large vug (170.7–171.32); highly resistive intraclasts (calcite) (Core 21R)
17	180.92–181.62	Wackestone-packstone	Interbedded; vugular
18	181.62–182.15	Packstone	
19	182.15–185.60	Wackestone–packstone	Variable cementation; moldic (gastropod) porosity
20	185.60–186.52	Mudstone-wackestone	Extreme moldic porosity
21	186.52–186.90	Mudstone-wackestone	Minor moldic porosity
22	186.90–197.07	Packstone	Vugular and moldic porosity; large vug (190.36–190.64)
23	197.07–197.59	Wackestone	Moldic porosity (Core 23R)
24	197.59–222.32	Packstone	Moldic porosity; grossly vugular in places; minor mudstone
25	222.32–224.10	Packstone-wackestone	Moldic porosity
26	224.10–223.13	Packstone	Moldic porosity; grossly vugular in places; well-cemented interval (227.9–228.1)
27	223.13–234.29	Packstone-wackestone	Moldic porosity
28	234.29–239.56	Packstone	Moldic porosity; grossly vugular in places
29	239.56–245.11	Wackestone	Moldic porosity (Core 28R)
30	245.11–267.95	Packstone	Moldic porosity; grossly vugular in places
31	267.95–271.60	Wackestone-mudstone	Well-indurated in places; porous
32	271.60–272.60	Mudstone-wackestone	Very minor moldic porosity
33	272.60–280.27	Packstone	Minor moldic porosity; well-indurated
34	280.27–282.80	Packstone-rudstone	
35	282.80–288.90	Wackestone-mudstone	Moldic porosity (Core 32R)
36	288.90–290.73	Packstone	Moldic porosity
37	290.73–299.46	Packstone-wackestone	Moldic porosity
38	299.46–299.69	Packstone	
39	299.69–307.43	Packstone-grainstone	Minor moldic porosity (Core 34R)
40	307.43–311.05	Wackestone-mudstone	Moldic porosity
41	311.05–317.72	Packstone	Moldic porosity; large vugs; very porous
42	317.72–333.80	Wackestone-mudstone	Moldic porosity; interbedded, but bedding is indistinct; minor grainstone (Cores 36R, 37R)
43	333.80–336.97	Packstone-grainstone	Minor moldic porosity
44	336.97–338.25	Packstone	Very porous; few well-indurated intervals
45	338.25–340.58	Wackestone-mudstone	
46	340.58–341.20	Mudstone	Moldic porosity; very large vugs (3–4 cm) (Core 38R)
47	341.20–344.31	Packstone	
48	344.31–344.40	Mudstone	
49	344.40–347.26	Packstone	Minor moldic porosity; extremely porous zones
50	347.26–348.00	Packstone-grainstone	Minor moldic porosity
51	348.00–349.00	Wackestone-packstone	Finely interbedded with minor grainstone (Core 39R)
52	349.00–355.73	Packstone	
53	355.73–357.60	Packstone-grainstone	
54	357.60–359.20	Packstone-wackestone	(Core 41R)
55	359.20–364.09	Packstone-grainstone	(Core 41R)
56	364.09–370.00	Packstone-wackestone	Moldic porosity; extremely porous zones
57	370.00–405.98	Packstone	Moldic porosity; burrows; well-indurated interval (396.08–397.12)
58	405.98–409.15	Packstone	Very porous
59	409.15–410.95	Mudstone-wackestone	Mudstone intraclasts (Core 46R)
60	410.95–416.23	Packstone	Very porous; moldic porosity; burrowed
61	416.23–417.20	Mudstone-wackestone	Moldic porosity; burrowed
62	417.20–417.40	Mudstone	Minor moldic porosity
63	417.40–421.10	Packstone	Very porous
64	421.10–423.80	Wackestone-mudstone	Some bedding visible; minor moldic porosity; burrowed
65	423.80–425.80	Mudstone-wackestone	Moldic porosity
66	425.80–426.80	Packstone-wackestone	Minor moldic porosity
67	426.80–428.87	Packstone	Very porous
68	428.87–429.16	Mudstone	
69	429.16–430.25	Wackestone-mudstone	Stylolites
70	430.25–432.87	Wackestone-mudstone	Wacke. grading up to mud
71	432.87–434.20	Wackestone-mudstone	Wacke. grading up to mud; mudstone intraclast
72	434.20–436.15	Wackestone-mudstone	Wacke. grading up to wacke.–mud
73	436.15–438.20	Wackestone-mudstone	Wacke. grading up to mud–wacke.

Table 1 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
74	438.20–440.77	Wackestone-mudstone	Very porous wacke. with moldic porosity grading up to mudstone
75	440.77–441.42	Packstone	
76	441.42–445.24	Mudstone-wackestone	Minor moldic porosity; burrowed
77	445.24–446.48	Wackestone-mudstone	Moldic porosity; burrowed
78	446.48–447.97	Packstone	
79	447.97–448.42	Wackestone-mudstone	
80	448.42–450.40	Mudstone-wackestone	Moldic porosity (Core 50R)
81	450.40–452.29	Wackestone-mudstone	
82	452.29–454.02	Packstone	Very porous, (mudstone?) intraclasts
83	454.02–456.37	Wackestone-mudstone	Moldic porosity
84	456.37–457.63	Mudstone-wackestone	Minor moldic porosity; burrowed (Core 51R)
85	457.63–461.80	Wackestone-mudstone	Some bedding visible; burrowed
86	461.80–462–92	Mudstone-wackestone	Large patches with high intergranular porosity
87	462.92–465.40	Packstone	Minor mudstone interbeds
88	465.40–466.62	Wackestone-mudstone	Moldic porosity; burrowed
89	466.62–467.07	Mudstone-wackestone	
90	467.07–469.14	Wackestone-mudstone	Minor moldic porosity; burrowed
91	469.14–472.20	Mudstone-wackestone	Moldic porosity; burrowed
92	472.20–476.60	Packstone	Very porous, intraclasts
93	476.60–476.98	Packstone	
94	476.98–477.11	Grainstone	
95	477.11–478.71	Wackestone-mudstone	Wacke grading up to mudstone; burrowed
96	478.71–481.50	Wackestone-mudstone	Moldic porosity, burrowed (Core 53R)
97	481.50–483.30	Packstone	Burrowed
98	483.30–485.90	Packstone	Irregular patches of mudstone; intraclasts; burrowed; some bedding visible
99	485.90–486.79	Wackestone-mudstone	Minor moldic porosity
100	486.79–488.26	Packstone	
101	488.26–489.63	Wackestone-mudstone	
102	489.63–490.60	Mudstone-wackestone	Minor moldic porosity
103	490.60–491.62	Packstone	Sharp basal contact
104	491.62–493.64	Mudstone-wackestone	Moldic porosity
105	493.64–496.40	Wackestone-mudstone	Some bedding visible; moldic porosity
106	496.40–496.64	Mudstone	(Core 54R)
107	496.64–498.35	Packstone	Borrowed
108	498.35–501.91	Mudstone-wackestone	
109	501.91–504.08	Packstone	Burrowed
110	504.08–507.69	Wackestone-mudstone	Intraclasts
111	507.69–509.25	Mudstone-wackestone	
112	509.25–509.97	Wackestone-mudstone	
113	509.97–513.77	Packstone	Very porous at base
114	513.77–516.64	Wackestone-mudstone	Minor moldic porosity; some bedding visible at top (Core 57R)
115	516.64–524.27	Packstone	Highly variable intergranular porosity; moldic porosity
116	524.27–527.00	Wackestone-mudstone	Some bedding visible in lower half
117	527.00–529.85	Packstone	
118	529.85–530.92	Wackestone-mudstone	
119	530.92–532.45	Packstone	
120	532.45–534.87	Wackestone-mudstone	Moldic porosity; burrowed (Core 58R)
121	534.87–537.00	Packstone	Mudstone interbeds at base; minor moldic porosity
122	537.00–541.38	Packstone	Moldic porosity; burrowed
123	541.38–544.19	Wackestone-mudstone	Moldic porosity; burrowed (Core 59R)
124	544.19–544.80	Mudstone	Moldic porosity
125	544.80–547.20	Wackestone-mudstone	
126	547.20–549.80	Packstone	Very porous
127	549.80–551.89	Wackestone-mudstone	Moldic porosity
128	551.89–553.00	Mudstone-wackestone	Minor moldic porosity (Core 60R)
129	553.00–557.26	Mudstone	Moldic porosity
130	557.26–561.00	Wackestone-mudstone	Moldic porosity; burrowed (Core 61R)
131	561.00–564.40	Packstone	Minor moldic porosity; bottom third is burrowed
132	564.40–566.00	Wackestone-mudstone	Moldic porosity
133	566.00–567.90	Mudstone-wackestone	Moldic porosity; burrowed
134	567.90–568.63	Wackestone-mudstone	Minor moldic porosity
135	568.63–571.00	Packstone	Moldic porosity; burrowed
136	571.00–573.00	Wackestone-mudstone	Moldic porosity; burrowed
137	573.00–578.35	Packstone	Moldic porosity; burrowed
138	578.35–579.91	Wackestone-mudstone	Moldic porosity; burrowed
139	579.91–581.20	Mudstone-wackestone	Moldic porosity; burrowed
140	581.20–587.00	Wackestone-mudstone	Moldic porosity; burrowed
141	587.00–587.50	Mudstone	Massive
142	587.50–588.78	Wackestone-mudstone	Moldic porosity; burrowed (Core 64R)
143	588.78–592.63	Packstone	Porous; moldic porosity; burrowed
144	592.63–593.25	Wackestone-mudstone	Minor moldic porosity
145	593.25–598.40	Packstone	Very porous
146	598.40–600.83	Wackestone-mudstone	Moldic porosity; burrowed; some bedding visible
147	600.83–603.17	Wackestone-mudstone	Moldic porosity; burrowed
148	603.17–603.63	Mudstone	Stratified
149	603.63–608.34	Packstone	Moldic porosity; intraclasts (may be filled burrows); burrowed
150	608.34–609.40	Mudstone	Extreme moldic porosity
151	609.40–610.12	Packstone	Moldic porosity
152	610.12–610.42	Mudstone	Moldic porosity
153	610.42–614.56	Wackestone-mudstone	Stratified; minor moldic porosity
154	614.56–616.36	Mudstone-wackestone	Stratification partially obscured by burrows; minor moldic porosity
155	616.36–619.23	Packstone	Moldic porosity; somewhat burrowed (Core 67R)

Table 1 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
156	619.23–622.30	Wackestone-mudstone	Moldic porosity; burrowed
157	622.30–622.59	Mudstone	Sharp basal contact
158	622.59–627.80	Packstone	Moldic porosity; burrowed
159	627.80–630.42	Mudstone-wackestone	Moldic porosity; burrowed
160	630.42–638.51	Packstone	Very porous; moldic porosity; burrowed; mudstone interbeds (631.6, 636.3)
161	638.51–641.60	Wackestone-mudstone	Well-cemented; moldic porosity; minor bioturbation (Core 69R)
162	641.60–645.28	Packstone	Moldic porosity; burrowed
163	645.28–649.11	Wackestone-mudstone	Well-cemented; moldic porosity; extensively bioturbated (Core 70R)
164	649.11–650.72	Packstone	Regular patches of packstone; minor moldic porosity
165	650.72–653.40	Packstone	Moldic porosity; burrowed
166	653.40–655.56	Mudstone-wackestone	Muddy wackestone with mud interbeds; moldic porosity; minor bioturbation
167	655.56–660.76	Packstone	Extensive bioturbation; moldic porosity; clay seams (656.6) (Core 71R)
168	660.76–661.61	Packstone	Moldic porosity; burrowed
169	661.61–662.02	Mudstone	Finely interbedded clay seams
170	662.02–665.16	Packstone	Moldic porosity; burrowed
171	665.16–665.69	Wackestone-packstone	Minor moldic porosity; stylolites; clay seams (Core 72R)
172	665.69–667.23	Packstone	Moldic porosity; minor bioturbation
173	667.23–668.43	Wackestone-packstone	Interbedded; minor moldic porosity; burrowed
174	668.43–670.03	Packstone	Very porous; minor bioturbation
175	670.03–670.12	Wackestone	
176	670.12–672.20	Packstone	Minor moldic porosity; burrowed
177	672.20–672.70	Wackestone	
178	672.70–673.22	Packstone	
179	673.22–673.70	Wackestone	
180	673.70–675.20	Packstone	Minor moldic porosity; burrowed; identical to bed 176
181	675.20–675.70	Mudstone	Finely interbedded clay seams
182	675.70–678.17	Mudstone-wackestone	Minor moldic porosity; extensive bioturbation in places
183	678.17–680.92	Packstone	Very porous; moldic porosity
184	680.92–681.30	Packstone-grainstone	Minor moldic porosity
185	681.30–683.72	Grainstone	
186	683.72–684.37	Packstone-grainstone	Minor moldic porosity
187	684.37–689.32	Packstone-wackestone	Packstone with distinct wackestone intervals; moldic porosity; individual burrows very distinct (Core 74R)
188	689.32–689.77	Wackestone	
189	689.77–694.38	Packstone	Moldic porosity; burrowed
190	694.38–695.27	Wackestone	Minor bioturbation
191	695.27–696.36	Packstone	Upper half extensively burrowed; moldic porosity
192	696.36–696.77	Wackestone	
193	696.77–698.24	Packstone-wackestone	Burrowed
94	698.24–699.00	Mudstone	
195	699.00–699.38	Mudstone-wackestone	
196	699.38–702.20	Packstone	Minor bioturbation
197	702.20–702.56	Wackestone	
198	702.56–703.51	Packstone	Extensively burrowed
199	703.51–703.97	Wackestone	
200	703.97–706.73	Wackestone-packstone	Minor moldic porosity
201	706.73–709.05	Packstone	Burrowed
202	709.05–709.24	Grainstone-packstone	
203	709.24–711.17	Packstone-wackestone	Minor moldic porosity; burrowed; intraclasts
204	711.17–712.80	Wackestone	Clay seam (712.45); minor moldic porosity (Core 77R)
205	712.80–725.60	Packstone	Mudstone interbeds (716.6, 720.85, 722.0); minor moldic porosity
206	725.60–727.35	Wackestone-mudstone	Moldic porosity; burrowed (Core 78R)
207	727.35–727.60	Mudstone	
208	727.60–727.68	Clay	
209	727.68–728.11	Marly limestone	
210	728.11–728.75	Mudstone	Minor moldic porosity; burrowed
211	728.75–732.67	Packstone-wackestone	Minor moldic porosity; burrowed (Core 79R)
212	732.67–735.86	Packstone	Very fine–grained; minor wackestone at base (Core 80R)
213	735.86–738.29	Mudstone	Finely interbedded clay seams
214	738.29–744.74	Wackestone-mudstone	Moldic porosity; extensively burrowed; minor packstone intervals
215	744.74–747.50	Packstone	Moldic porosity
216	747.50–748.55	Clay	Minor mudstone
217	748.55–750.36	Wackestone-mudstone	Moldic porosity; moderately burrowed
218	750.36–750.90	Mudstone-wackestone	Minor moldic porosity; extensively burrowed
219	750.90–751.22	Wackestone-mudstone	Burrowed
220	751.22–751.83	Mudstone	Clayey limestone–mud
221	751.83–754.52	Wackestone-mudstone	Minor moldic porosity; minor bioturbation
222	754.52–755.39	Wackestone	Clay seams
223	755.39–755.85	Packstone-wackestone	Minor moldic porosity
224	755.85–761.91	Packstone	Moldic porosity; large burrows; clay seams (Core 82R)
225	761.91–763.80	Mudstone-wackestone	Moldic porosity; burrowed

Table 1 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
226	763.80–763.90	Mudstone	Clay seams
227	763.90–764.23	Mudstone-wackestone	Burrowed
228	764.23–765.60	Wackestone-packstone	Moldic porosity; burrowed
229	765.60–769.00	Packstone	Minor (10-cm) packstone intervals; moldic porosity; extensively burrowed
230	769.00–769.35	Wackestone	
231	769.35–770.02	Wackestone-packstone	Moldic porosity; burrowed
232	770.02–771.67	Packstone	Moldic porosity; intraclasts
233	771.67–772.20	Wackestone-packstone	Burrowed (Core 83R)
234	771.20–776.00	Packstone	Moldic porosity
235	776.00–776.94	Wackestone	Clay seams
236	776.94–778.30	Packstone	Minor moldic porosity; burrowed
237	778.30–779.38	Mudstone-wackestone	Clay seam at 779.32; minor moldic porosity
238	779.38–782.14	Wackestone-mudstone	Very fine–scale moldic porosity
239	782.14–782.23	Clay	
240	782.23–783.15	Mudstone-wackestone	Clay seam at 782.8; minor moldic porosity
241	783.15–793.23	Packstone	Abundant intraclasts at base; vertical fluid escape channels (or burrows) at base; upward fining
242	793.23–793.53	Laminated clayey limestone	(Core 85R)
243	793.53–796.12	Mudstone-wackestone	Extensively burrowed (Core 85R)
244	796.12–798.79	Wackestone-mudstone	Moldic porosity; extensively burrowed
245	798.79–799.13	Mudstone	
246	799.13–799.97	Packstone	Intraclasts (mudstone), dark (pyrite)–filled burrows
247	799.97–802.35	Marl	
248	802.35–803.03	Packstone	Clay seams; intraclasts
249	803.03–804.40	Marl	Intraclasts
250	804.40–806.86	Wackestone	Clay seams; moldic porosity; extensively burrowed
251	806.86–806.91	Clay	
252	806.91–809.20	Packstone	Clay seams; intraclasts, burrowed
253	809.20–811.96	Marl	Clay seams; fragments of conductive material; extensively burrowed (Core 87R)
254	811.96–813.24	Marl	Minor wackestone; clay seams
255	813.24–816.34	Packstone-wackestone	Burrowed
256	816.34–819.80	Packstone	
257	819.80–820.70	Packstone-marl	
258	820.70–823.55	Packstone	Large burrows; angular fragments (Core 88R)
259	823.55–824.29	Packstone-wackestone	Burrowed
260	824.29–825.20	Packstone	Large burrows
261	825.20–825.54	Packstone-wackestone	
262	825.54–827.65	Packstone-marl	Large burrows; intraclasts
263	827.65–829.07	Wackestone	Clay seams; moldic porosity; intraclasts
264	829.07–829.63	Packstone	Large burrows
265	829.63–831.00	Wackestone	Moldic porosity; intraclasts
266	831.00–831.30	Carbonaceous mudstone	(Core 89R, Sections 5,100–113, and 6, 0–16 cm)
267	831.30–831.75	Packstone	Moldic porosity; intraclasts
268	831.75–831.92	Clay	
269	831.92–832.10	Packstone	
270	832.10–834.68	Packstone	Clay seams
271	834.68–834.92	Clay	
272	834.92–835.12	Packstone	
273	835.12–835.57	Clay	
274	835.57–837.59	Basalt	

rudstone-grainstone) were grouped under rudstone. Algal-mat-rich intervals and laminite were grouped together. Inaccurate estimations of abundance arise from the minimum practical resolution of the FMS tool (0.5 cm). Clay in recovered core material is distributed as individual fine (millimeter-thickness) seams, intervals of closely spaced fine seams, and as sharply defined centimeter-scale beds. The presence of millimeter-scale clay seams can be distinguished in the best quality FMS images because of the large resistivity contrast with their surroundings, but because of the resolution limitations of the FMS tool, the thicknesses of such seams are falsely imaged as 0.5 to 1.0 cm. The same is probably true of the less common, thin, highly resistive, wackestone intervals and hard grounds. Bed thicknesses of 1 cm or less (as measured in the FMS images) were not included in the statistical analysis.

Packstone is the dominant lithology at Hole 865A (51%), whereas wackestone, which constitutes only 3% of the logged section, was the dominant lithology recovered. Similarly, except for the dolomites at the base of the section, wackestone, wackestone-mudstone, mudstone, and laminite dominated recovery at Hole 866A. The grainstones and packstones that make up 25% and 20% of the section, respectively, were poorly represented in the recovered core material.

SUMMARY OF LOG–CORE INTEGRATION FOR HOLE 865A

Both core samples identified as "speleothem" and the broad range of porosities that characterize the depth interval from 140.0 to 162.0 mbsf suggest that fresh water may have been present in the formation; however, carbon isotope data are inconclusive in this regard (Sager, Winterer, Firth, et al., 1993).

The depth interval from 162.0 to 600.0 mbsf consists almost exclusively of upward-fining sequences of packstone, wackestone, and mudstone. Typically, the packstones are extremely porous and have extensive moldic porosity, and the wackestones and mudstones, with and without moldic porosity, are burrowed. Alternating intervals of rhythmic variations in resistivity and homogeneous zones are common throughout this interval. The character of the gamma, density, and velocity (not shown) logs indicates the presence of many thin layers in the variable zones. The FMS shows numerous thin layers of alternating high and low resistivities on the order of 10 cm, with some as thin as 1 cm.

The first traces of clays were detected in cores at about 600 mbsf, and confirmed by elevated gamma readings. Clay seams of measur-

Table 2. Description of beds at Hole 866A (Resolution Guyot).

Bed number	Depth range (mbsf)	Lithology	Description
1	195.00–206.77	Wackestone-packstone	Poor resolution, large hole size
2	206.77–214.22	Packstone	Minor moldic porosity; burrowed; induration decreases downhole
3	214.22–214.72	Wackestone	(Core 24R)
4	214.72–216.30	Packstone	Minor moldic porosity; intraclasts
5	216.30–216.84	Boundstone	
6	216.84–223.05	Packstone	Minor moldic porosity
7	223.05–223.43	Rudstone	
8	223.43–224.70	Packstone	Intraclasts; bottom 20 cm more porous
9	224.70–224.89	Mudstone	Sharp bed boundaries
10	224.89–226.32	Packstone-rudstone	Very porous; porosity increases downhole; minor grainstone (Core 25R)
11	226.32–227.55	Mudstone	
12	227.55–229.45	Wackestone-packstone	Minor moldic porosity
13	229.45–233.92	Packstone	Minor moldic porosity; burrowed (229.8)
14	233.92–235.40	Rudstone	
15	235.40–241.02	Packstone	Minor moldic porosity; intraclasts; extensively burrowed; minor grainstone (235.8?)
16	241.02–242.25	Mudstone	Minor moldic porosity
17	242.25–246.75	Wackestone-packstone	Minor moldic porosity; vertical fracture (247–246) could be drilling-related; grainstone interbeds (Core 27R)
18	246.75–251.98	Packstone	Minor moldic porosity
19	251.98–253.04	Rudstone-packstone	Moldic porosity
20	253.04–254.05	Grainstone	Moldic porosity (Core 28R)
21	254.05–255.06	Rudstone	
22	255.06–258.46	Wackestone-packstone	Fossiliferous; minor moldic porosity; intergranular porosity increases upsection
23	258.46–260.46	Rudstone	
24	260.46–261.89	Packstone-wackestone	Packstone grading up to wackestone
25	261.89–264.40	Rudstone	Intergranular porosity decreases upsection; large-scale moldic porosity; intraclasts, 263.4–264.4 (Core 29R)
26	264.40–269.16	Wackestone-packstone	Minor moldic porosity; extensive bioturbation
27	269.16–270.31	Packstone-wackestone	Minor moldic porosity; intraclasts; stylolites
28	270.31–270.74	Wackestone-packstone	
29	270.74–272.40	Rudstone	Dissolution halos
30	272.40–273.60	Wackestone-packstone	Moldic porosity
31	273.60–273.95	Packstone-grainstone	Moldic porosity
32	273.95–275.69	Wackestone-packstone	Moldic porosity
33	275.69–276.70	Packstone	Minor moldic porosity
34	276.70–277.43	Rudstone	Moldic porosity
35	277.43–281.80	Packstone-wackestone	Extensive moldic porosity; intergranular porosity decreases upsection
36	281.80–283.80	Wackestone	Moldic porosity (Core 31R)
37	283.80–285.77	Mudstone	Moldic porosity (Core 31R)
38	285.77–289.68	Wackestone-mudstone	Moldic porosity (Core 31R)
39	289.68–290.73	Packstone	Moldic porosity
40	290.73–295.00	Wacketone-mudstone	Very large vugs (10–12 cm); stylolites, 294.0 (Core 32R)
41	295.00–296.08	Wackestone	Moldic porosity
42	296.08–296.60	Rudstone-packstone	
43	296.60–299.20	Rudstone	
44	299.20–303.34	Packstone	Moldic porosity
45	303.34–303.80	Packstone-wackestone	
46	303.80–304.58	Rudstone	
47	304.58–305.80	Packstone	Moldic porosity
48	305.80–306.20	Packstone-wackestone	Moldic porosity
49	306.20–307.40	Rudstone	
50	307.40–308.86	Packstone	Moldic porosity; uniform intergranular porosity
51	308.86–310.15	Rudstone	Very porous
52	310.15–311.64	Packstone-rudstone	Moldic porosity
53	311.64–312.25	Packstone-wackestone	Moldic porosity; burrowed
54	312.25–313.80	Packstone	Very porous; moldic porosity; burrowed
55	313.80–315.00	Mudstone-wackestone	Clayey limestone; moldic porosity; minor grainstone
56	315.00–321.80	Packstone	Wacke-packstone in places; mudstone intraclasts; moldic porosity increases upsection; minor rudstone at 320.0
57	321.80–322.60	Rudstone-packstone	Minor moldic porosity
58	322.60–324.00	Rudstone	
59	324.00–325.30	Mudstone-wackestone	Intraclasts; uniform intergranular porosity; minor (Core35R)
60	325.30–325.86	Rudstone	Very porous
61	325.86–326.23	Packstone-rudstone	Moldic porosity
62	325.23–329.44	Packstone	Moldic porosity
63	329.44–331.40	Rudstone-packstone	Moldic porosity; sharp upper contact
64	331.40–332.87	Packstone-rudstone	Moldic porosity
65	332.87–333.37	Rudstone-packstone	Moldic porosity
66	333.37–334.37	Packstone	Moldic porosity; intraclasts
67	334.37–335.86	Packstone-rudstone	Moldic porosity
68	335.86–346.26	Mudstone	Extreme moldic porosity; intergranular porosity increases downsection; large (2–3 cm) molds to 340.2; smaller molds (1–2 cm) in lower part of section (Cores 36R, 37R, 38R)
69	346.26–347.04	Wackestone-mudstone	Moldic porosity; mudstone intraclasts
70	347.04–347.24	Mudstone	Moldic porosity
71	347.24–349.00	Mudstone-wackestone	Small-scale (< 1 cm) moldic porosity
72	349.00–349.30	Rudstone-packstone	
73	349.30–350.53	Rudstone-wackestone	Moldic porosity; intraclasts
74	350.53–354.13	Mudstone-wackestone	Minor moldic porosity
75	354.13–356.12	Mudstone	Minor moldic porosity
76	356.12–362.30	Wackestone-mudstone	Minor moldic porosity; stratified; mudstone intraclasts
77	362.30–363.58	Packstone	
78	363.58–363.95	Mudstone	Massive
79	363.95–364.63	Wackestone	Minor moldic porosity
80	364.63–370.40	Rudstone-packstone	Rudstone at base grading up to packstone; intraclasts; moldic porosity
81	370.40–370.53	Mudstone	Massive

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
82	370.53–372.05	Packstone	Moldic porosity; intraclasts
83	372.05–373.40	Packstone	Minor moldic porosity; lower intergranular porosity than Bed 82; stylolites; tension gash
84	373.40–374.88	Packstone-wackestone	
85	374.88–375.68	Wackestone-packstone	(Core 41R)
86	375.68–383.20	Packstone	Minor moldic porosity; variable intergranular porosity stylolites; tension gash
87	383.20–387.20	Wackestone-mudstone	Minor boundstone(?) at 384.5; minor moldic porosity (Core 42R)
88	387.20–388.20	Packstone	
89	388.20–391.67	Wackestone-mudstone	Vertical fractures probably drilling-related; mudstone intraclasts (391–391.5); moldic porosity
90	391.67–392.77	Packstone	Mudstone intraclasts
91	392.77–392.96	Wackestone-mudstone	
92	392.96–393.90	Mudstone-wackestone	Moldic porosity (Core 43R)
93	393.90–396.09	Wackestone-mudstone	Massive; minor moldic porosity (Core 44R)
94	396.09–397.30	Packstone	Moldic porosity; intraclasts
95	397.30–399.80	Rudstone	Vertical fracture probably drilling-related
96	399.80–399.97	Mudstone	Massive
97	399.97–400.87	Packstone	Intraclasts; stylolites
98	400.87–401.24	Mudstone	Massive
99	401.24–403.09	Packstone	Large-scale (~4 cm) moldic porosity; mudstone intraclasts; vertical fractures probably drilling related
100	403.09–403.60	Mudstone	
101	403.60–404.00	Packstone	
102	404.00–407.40	Mudstone	Minor moldic porosity; burrowed(?)
103	407.40–409.80	Mudstone	Variable cementation; moldic porosity
104	409.80–411.90	Packstone	Minor moldic porosity; stylolites
105	411.90–413.60	Mudstone-wackestone	Moldic porosity
106	413.60–430.24	Mudstone-wackestone	Extreme moldic porosity; intergranular porosity highly variable; stylolites (Cores 46R, 47R)
107	430.24–431.40	Wackestone-mudstone	
108	431.40–442.01	Packstone	Very porous with moldic porosity 433.0 to top of section; middle part less porous; very porous at base
109	442.01–443.50	Wackestone-mudstone	
110	443.50–444.00	Grainstone	(Core 48R)
111	444.00–444.83	Wackestone-mudstone	
112	444.83–449.29	Packstone	Variable induration
113	449.29–450.10	Marl	
114	450.10–456.53	Packstone	Very porous at base; mudstone(?) intraclasts (Core 50R)
115	456.53–457.03	Marl	
116	457.03–457.60	Packstone	
117	457.60–458.48	Marl	
118	458.48–465.10	Packstone	Moldic porosity; several well-cemented intervals; minor marl interbeds; minor grainstone
119	465.10–466.44	Packstone	Moldic porosity
120	466.44–466.80	Grainstone	
121	466.80–467.33	Packstone	Moldic porosity
122	467.33–467.55	Wackestone	
123	467.55–468.38	Packstone	Moldic porosity; mudstone intraclasts or burrow fillings
124	468.38–468.86	Grainstone-packstone	Minor moldic porosity (Core 51R)
125	468.86–469.03	Packstone	Moldic porosity; intraclasts (Core 51R)
126	469.03–469.39	Wackestone	
127	469.39–470.33	Packstone	
128	470.33–471.00	Wackestone	
129	471.00–472.63	Packstone	Highly variable intergranular porosity; stylolites
130	472.63–472.95	Packstone-grainstone	
131	472.95–473.44	Packstone-wackestone	Moldic porosity; vertical fractures
132	473.44–473.84	Wackestone-packstone	
133	473.84–476.22	Packstone-wackestone	Packstone with wackestone interbeds; very minor moldic porosity
134	476.22–474.56	Packstone-grainstone	Stylolites
135	474.56–477.80	Packstone	
136	477.80–478.58	Packstone-grainstone	Stylolites
137	478.58–479.00	Packstone	
138	479.00–479.47	Packstone-wackestone	Stylolites; intraclasts
139	479.47–480.65	Packstone	Intraclasts; vertical fractures
140	480.65–481.05	Wackestone-packstone	
141	481.05–481.40	Packstone	Intraclasts
142	481.40–481.60	Wackestone-grainstone	
143	481.60–482.82	Packstone	Moldic porosity; stylolites
144	482.82–482.98	Wackestone	
145	482.98–484.60	Packstone	Marly interval (483.6–483.8); stylolites
146	484.60–485.48	Marl	Stylolites
147	485.48–486.83	Packstone	Minor (<2 cm) wackestone interval; stylolites
148	486.83–486.96	Wackestone	Massive
149	486.96–487.82	Wackestone-packstone	Minor moldic porosity
150	487.82–489.32	Packstone-wackestone	Moldic porosity; vertical fracture (drilling related)
151	489.32–490.43	Packstone	Very porous; moldic porosity
152	490.43–490.60	Wackestone	
153	490.60–490.83	Wackestone-packstone	
154	490.83–491.57	Packstone	
155	491.57–492.50	Wackestone-packstone	
156	492.50–494.05	Packstone-wackestone	
157	494.05–494.20	Wackestone	
158	494.20–495.56	Packstone	Moldic porosity
159	495.56–495.80	Wackestone	Minor moldic porosity
160	495.80–496.60	Packstone	Moldic porosity; stylolites
161	496.60–496.80	Wackestone	
162	496.80–497.22	Packstone	Minor moldic porosity; intraclasts

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
163	497.22–497.40	Wackestone	
164	497.40–498.95	Packstone	Minor moldic porosity; intraclast
165	498.95–500.97	Wackestone	Minor grainstone; minor moldic porosity (Core 54R)
166	500.97–501.49	Wackestone-packstone	
167	501.49–501.75	Packstone	Moldic porosity
168	501.75–502.64	Wackestone-packstone	Minor grainstone
169	502.64–503.70	Packstone	
170	503.70–503.80	Wackestone	
171	503.80–504.09	Packstone	Moldic porosity
172	504.09–505.40	Packstone-wackestone	
173	505.40–506.40	Packstone	
174	506.40–508.05	Packstone-wackestone	Minor grainstone
175	508.05–508.51	Packstone-grainstone	(Core 55R)
176	508.51–509.55	Packstone	
177	509.55–509.80	Wackestone	
178	509.80–511.18	Packstone	
179	511.18–512.58	Packstone-wackestone	
180	512.58–514.68	Packstone	Moldic porosity
181	514.68–515.04	Packstone-wackestone	
182	515.04–517.07	Packstone	Moldic porosity; stylolites (Core 56R)
183	517.07–517.63	Wackestone	
184	517.63–519.20	Packstone-wackestone	Minor moldic porosity; minor grainstone
185	519.20–520.18	Packstone	
186	520.18–520.35	Packstone-wackestone	
187	520.35–520.57	Wackestone	
188	520.57–522.86	Packstone	Moldic porosity limited to distinct intervals
189	522.86–523.08	Packstone-grainstone	
190	523.08–523.91	Packstone-wackestone	
191	523.91–525.37	Packstone	Moldic porosity; intraclasts
192	525.37–526.24	Packstone-grainstone	
193	526.24–526.63	Packstone-wackestone	
194	526.63–527.95	Packstone	Intraclasts at base (probably of underlying Unit 195); stylolites
195	527.95–529.11	Packstone-grainstone	
196	529.11–531.44	Packstone-wackestone	
197	531.44–532.69	Packstone-grainstone	
198	532.69–534.12	Packstone	Minor moldic porosity; intraclasts
199	534.12–534.31	Packstone-grainstone	(Core 58R)
200	534.31–534.57	Packstone	Intraclasts
201	534.57–534.94	Packstone-grainstone	
202	534.94–535.53	Grainstone	
203	535.53–537.93	Wackestone-rudstone	
204	537.93–541.60	Packstone-grainstone	
205	541.60–542.07	Packstone	
206	542.07–542.55	Packstone-grainstone	
207	542.55–544.14	Packstone	Intraclasts
208	544.14–544.50	Wackestone	
209	544.50–544.88	Wackestone-packstone	
210	544.88–546.62	Packstone	
211	546.62–546.77	Wackestone	
212	546.77–549.00	Packstone	Variable cementation
213	549.00–550.20	Packstone-wackestone	
214	550.20–551.20	Packstone	Moldic porosity
215	551.20–551.40	Wackestone	
216	551.40–552.50	Packstone	
217	552.50–553.09	Wackestone-packstone	
218	553.09–553.33	Packstone-grainstone	(Core 60R)
219	553.33–556.42	Packstone-wackestone	Packstone with ~2–cm intervals of wackestone; minor moldic porosity
220	556.42–560.03	Packstone	Moldic porosity; intraclasts; dipping basal contact
221	560.03–560.20	Wackestone	
222	560.20–563.18	Packstone	Moldic porosity; burrows(?)
223	563.18–563.54	Packstone-grainstone	
224	563.54–563.84	Grainstone	
225	563.84–564.16	Packstone-grainstone	
226	564.16–566.20	Packstone	Vertical fracture or burrow (564.4)
227	566.20–566.35	Packstone-wackestone	
228	566.35–567.80	Packstone	
229	567.80–567.91	Wackestone	
230	567.91–569.23	Packstone	Moldic porosity; top is burrowed
231	569.23–569.80	Packstone-grainstone	
232	569.80–570.36	Packstone-wackestone	
233	570.36–573.79	Packstone-grainstone	
234	573.79–577.98	Packstone-wackestone	
235	577.98–578.88	Rudstone	
236	578.88–579.98	Wackestone	Minor moldic porosity
237	579.98–582.47	Wackestone-packstone	Numerous intraclasts and/or burrows; minor moldic porosity
238	582.47–584.89	Packstone-wackestone	Moldic porosity; intraclasts
239	584.89–585.82	Wackestone	
240	585.82–586.20	Grainstone-packstone	Minor moldic porosity; burrowed (Core 63R)
241	586.20–587.42	Rudstone-wackestone	
242	587.42–589.25	Grainstone-packstone	Clay seams
243	589.25–590.17	Packstone	Clay seams
244	590.17–591.25	Grainstone-packstone	
245	591.25–592.00	Packstone	Moldic porosity; intraclasts
246	592.00–593.80	Grainstone	Minor moldic porosity; stylolites
247	593.80–595.72	Packstone	Minor moldic porosity; intraclasts; stylolites (Core 64R)
248	595.72–596.03	Wackestone	(Core 64R)
249	596.03–596.81	Packstone-wackestone	
250	596.81–598.05	Grainstone	Moldic porosity
251	598.05–599.85	Grainstone	Minor moldic porosity

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
252	599.85–600.72	Packstone	Dissolution halos
253	600.72–600.97	Wackestone	(Core 65R)
254	600.97–606.22	Packstone	Minor moldic porosity
255	606.22–607.37	Packstone-grainstone	
356	607.37–608.30	Grainstone	Intraclasts
257	608.30–609.82	Packstone-wackestone	Intraclasts
258	609.82–610.33	Packstone	
259	610.33–611.27	Wackestone-packstone	
260	611.27–612.58	Packstone-rudstone	
261	612.58–613.16	Wackestone	
262	613.16–617.15	Packstone	Minor grainstone; minor moldic porosity
263	617.15–618.13	Wackestone	
264	618.13–621.66	Packstone	Moldic porosity; numerous intraclasts
265	621.66–621.80	Wackestone	
266	621.80–625.20	Packstone	Moldic porosity; intraclasts
267	625.20–625.68	Packstone-grainstone	(Core 67R)
268	625.68–625.83	Grainstone	
269	625.83–627.17	Packstone	
270	627.17–627.30	Grainstone	
271	627.30–629.03	Wackestone-packstone	(Core 68R)
272	629.03–629.95	Packstone	
273	629.95–632.10	Packstone-wackestone	Minor moldic porosity
274	632.10–634.80	Packstone	Moldic porosity; stylolites
275	634.80–635.39	Packstone-grainstone	
276	635.39–637.20	Packstone	
277	637.20–638.04	Packstone-grainstone	
278	638.04–640.48	Packstone	
279	640.48–641.11	Wackestone-packstone	
280	641.11–642.27	Packstone-wackestone	Intraclasts
281	642.27–643.46	Packstone-wackestone	
282	643.46–648.00	Packstone	Burrowed; burrow fillings both light (calcite) and dark (clay, pyrite?)
283	648.00–649.06	Wackestone-mudstone	Contact with Unit 282 is gradational
284	649.06–649.27	Mudstone	
285	649.27–649.54	Laminites	Clay seams
286	649.54–650.27	Mudstone	Muds and clays, some stratified, some well-mixed; this is a single, upward-fining unit
287	650.27–650.53	Laminites	Minor mudstone
288	650.53–652.45	Mudstone	Burrowed
289	652.45–652.73	Packstone	Cementation highly variable
290	652.73–653.40	Mudstone	Minor moldic porosity; clay seams; sharp basal contact
291	653.40–654.93	Packstone	Minor moldic porosity
292	654.93–655.48	Wackestone-mudstone	Minor moldic porosity (Core 70R)
293	655.48–655.57	Mudstone-grainstone	(Core 70R)
294	655.57–655.90	Mudstone	Massive
295	655.90–656.32	Mudstone	Clay seams
296	656.32–657.89	Packstone	
297	657.89–658.23	Wackestone-mudstone	Intraclast
298	658.23–658.48	Mudstone–wackestone	
299	658.48–661.50	Packstone	
300	661.50–663.94	Mudstone	
301	663.94–663.96	Clay	
302	663.96–665.24	Mudstone	Mudstone laminites with clay (Core 71R)
303	665.24–665.85	Wackestone	
304	665.85–668.25	Packstone–wackestone	Minor moldic porosity; intraclasts
305	668.25–669.85	Packstone	Very porous; bimodal moldic porosity
306	669.85–671.90	Wackestone-mudstone	Interbedded wackestones and mudstones; clay seams; stylolites (Core 72R)
307	671.90–673.37	Packstone	Moldic porosity
308	673.37–674.50	Mudstone-wackestone	Burrowed
309	674.50–674.60	Mudstone	Massive
310	674.60–675.13	Rudstone	
311	675.13–675.70	Packstone	Moldic porosity
312	675.70–676.20	Packstone-wackestone	(Core 73R)
313	676.20–676.43	Mudstone	Mudstone laminites with clay
314	676.43–677.50	Rudstone	
315	677.50–676.60	Grainstone	Mudstone(?) intraclasts; stylolites (Core 73R)
316	676.60–678.75	Mudstone	Clay seam
317	678.75–680.11	Packstone	Moldic porosity; intraclasts
318	680.11–682.20	Rudstone	Grainstone interbeds
319	682.20–683.45	Grainstone	Moldic porosity; cross-bedding
320	683.45–687.63	Rudstone	Grading downward to packstone-grainstone
321	687.63–688.03	Grainstone	
322	688.03–690.36	Wackestone-mudstone	Minor moldic porosity
323	690.36–690.88	Mudstone	Moldic porosity
324	690.88–691.84	Wackestone-mudstone	Moldic porosity
325	691.84–694.97	Grainstone	Fine- to medium-grained; downward-fining; thinly bedded to massive; clay seams in top of section; cross-bedding (Core 75R)
326	694.97–695.79	Grainstone	Clay seams; burrowed; slumps(?)
327	695.79–700.81	Grainstone	Minor rudstone; minor packstone intervals; minor moldic porosity (Core 75R)
328	700.81–702.58	Rudstone	
329	702.58–706.90	Grainstone	Medium-fine-grained; minor packstone
330	706.90–709.25	Rudstone-grainstone	
331	709.25–710.46	Grainstone	Medium-fine-grained
332	710.46–717.34	Wackestone-rudstone	Minor grainstone
333	717.34–721.83	Grainstone	Medium- to coarse-grained; minor moldic porosity; well-cemented intervals
334	721.83–732.33	Grainstone	Coarse-grained; well-cemented

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
335	732.33–725.33	Grainstone	Medium- to very fine-grained
336	725.33–729.06	Grainstone	Medium–grained; bioturbation (or slumping?); minor moldic porosity; variable cementation
337	729.06–729.73	Grainstone	Well-sorted, medium-grained; intraclasts (Core 79R)
338	729.73–732.82	Grainstone	Medium-fine-grained; moldic porosity; intraclasts at base (Core 79R)
339	732.82–741.60	Grainstone	Coarse- to medium-grained; upward-fining; clay seams; packstone interbeds; moldic porosity
340	741.60–743.50	Grainstone-rudstone	
341	743.50–747.00	Rudstone	
342	747.00–748.96	Rudstone-grainstone	
343	748.96–752.61	Rudstone	
344	752.61–756.39	Grainstone	Minor packstone; upward-fining; moldic porosity
345	756.39–757.23	Rudstone	
346	757.23–758.05	Packstone-rudstone	Moldic porosity; intraclasts
347	758.05–760.32	Wackestone	
348	760.32–763.23	Rudstone	
349	763.23–769.63	Grainstone	Minor packstone and wackestone intervals; moldic porosity; intraclasts (Core 82R)
350	769.63–770.25	Wackestone	
351	770.25–772.90	Rudstone	
352	772.90–774.45	Grainstone	Downward-fining
353	774.45–778.27	Rudstone-grainstone	
354	778.27–781.04	Grainstone	Minor wackestone
355	781.04–786.47	Rudstone-grainstone	
356	786.47–788.18	Packstone-grainstone	Intraclasts; dissolution halos
357	788.18–788.21	Wackestone	
358	788.21–790.75	Grainstone-packstone	
359	790.75–790.87	Mudstone	Calcrete(?); very well-cemented; sharp upper contact
360	790.87–792.70	Packstone	Very porous
361	792.70–794.30	Wackestone	
362	794.30–795.11	Packstone	(Core 85R)
363	795.11–796.26	Packstone-wackestone	(Core 85R)
364	796.26–796.80	Rudstone	
365	796.80–797.78	Rudstone-grainstone	
366	797.78–798.10	Wackestone	Interbedded packstone and algal mat; clay intervals
367	798.10–798.84	Mudstone	Massive
368	798.84–801.80	Wackestone	Interbedded packstone and algal mat; distinct bedding
369	801.80–805.73	Packstone	Downward-fining; moldic porosity; intraclasts
370	805.73–806.60	Wackestone	Interbedded algal mat and wackestone; clay intervals at base of section
371	806.60–807.63	Mudstone	Minor wackestone; intraclasts at base (Core 86R)
372	807.63–809.70	Wackestone	Finely bedded packstones and algal mat; minor moldic porosity
373	809.70–811.35	Packstone	Intraclasts
374	811.35–812.59	Packstone-wackestone	Laminated with algal mat
375	812.59–813.93	Rudstone-wackestone	Moldic porosity; intraclasts
376	813.93–814.73	Packstone-wackestone	Laminated with algal mat (Core 87R)
377	814.73–818.41	Packstone	Downward-fining; minor intervals of grainstone and rudstone; moldic porosity (Core 87R)
378	818.41–819.49	Packstone	Coarse-grained; well-cemented interval at 819.2
379	819.49–821.60	Packstone	Small vugs at base; intraclasts
380	821.60–822.09	Packstone	Grainstone intervals and minor wackestone intervals
381	822.09–822.53	Wackestone	
382	822.53–823.24	Wackestone	Interbeds of clay and wackestone
383	823.24–823.46	Clay	
384	823.46–824.43	Marl	
385	824.43–824.97	Marl	Burrowed
386	824.97–826.64	Packstone-wackestone	With algal mat; numerous clay intervals; clay increases downsection (Core 88R)
387	826.64–827.93	Wackestone-rudstone	
388	827.93–828.24	Packstone	High intergranular porosity
389	828.24–829.65	Algal mat	Interbedded algal mat, mudstone, minor packstone; clay seams
390	829.65–831.82	Packstone	Numerous rounded clay and limestone intraclasts; limestone intraclasts concentrated at base (831.63–831.82)
391	831.82–831.99	Clay	
392	831.99–832.70	Wackestone	Some laminites (Core 89R)
393	832.70–832.76	Clay	(Core 89R)
394	832.76–833.38	Wackestone	Some laminites (Core 89R)
395	833.38–834.09	Packstone	(Core 89R)
396	834.09–834.95	Packstone-grainstone	Intraclasts (Core 89R)
397	834.95–835.48	Wackestone-grainstone	
398	835.48–836.00	Laminites	
399	836.00–836.08	Clay	
400	836.08–836.54	Wackestone-grainstone	
401	836.54–836.96	Packstone	Intraclasts
402	836.96–837.09	Wackestone	
403	837.09–837.52	Laminites	
404	837.52–838.70	Wackestone	
405	838.70–839.00	Rudstone	
406	839.00–839.76	Packstone-grainstone	Minor intraclasts
407	839.76–839.98	Wackestone-grainstone	
408	839.98–840.19	Clay seams	
409	840.19–841.00	Mudstone	
410	841.00–841.33	Clay	Clay seams and laminites
411	841.33–842.55	Packstone-wackestone	
412	842.55–842.65	Clay	Clay seams and laminites
413	842.65–843.32	Packstone	
414	843.32–843.87	Packstone-wackestone	
415	843.87–844.28	Rudstone	
416	844.28–844.40	Wackestone	

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
417	844.40–844.53	Grainstone	
418	844.53–845.13	Wackestone	
419	845.13–845.22	Clay	
420	845.22–845.71	Wackestone	
421	845.71–846.49	Packstone	
422	846.49–847.40	Wackestone-grainstone	
423	847.40–847.82	Wackestone	
424	847.82–848.80	Packstone	
425	848.80–849.48	Wackestone	
426	849.48–849.68	Clay	
427	849.68–852.02	Wackestone	Minor packstone
428	852.02–853.34	Clay	Clay intervals, algal mat, laminites; minor mudstone or wackestone intervals
429	853.34–858.03	Grainstone	Minor wackestone and mudstone intervals; clay seams and laminite intervals
430	858.03–859.53	Packstone	Minor grainstone (Core 91R)
431	859.53–860.59	Grainstone	
432	860.59–861.38	Packstone-grainstone	
433	861.38–862.60	Wackestone	(Core 92R)
434	862.60–863.54	Grainstone	Coarse-grained; packstone intervals
435	863.54–864.80	Grainstone	Fine-grained; sharp increase in porosity
436	864.80–865.25	Grainstone	Coarse grainstones; minor packstone
437	865.25–866.38	Wackestone	
438	866.38–869.44	Packstone-grainstone	
439	869.44–870.20	Wackestone	
440	870.20–870.51	Wackestone-rudstone	
441	870.51–871.23	Wackestone	
442	871.23–871.46	Rudstone	
443	871.46–874.50	Wackestone-packstone	
444	874.50–875.57	Grainstone	
445	875.57–876.34	Wackestone	
446	876.34–881.66	Rudstone	
447	881.66–882.03	Wackestone-rudstone	
448	882.03–882.30	Rudstone	
449	882.30–890.16	Grainstone	Grades downward into grainstone-packstone; moldic porosity evident in interval 886.15–886.55 (Core 94R)
450	890.16–891.97	Rudstone-packstone	
451	891.97–893.48	Packstone-grainstone	
452	893.48–896.36	Packstone	Grades upward to rudstone-grainstone
453	896.36–897.06	Packstone-grainstone	
454	897.06–898.00	Rudstone-grainstone	
455	898.00–899.10	Wackestone-grainstone	Wackestone grading upward to grainstone
456	899.10–901.60	Wackestone-packstone	(Core 96R)
457	901.60–909.53	Packstone-rudstone	Alternating beds of packstone and rudstone; boundaries gradational; minor wackestone
458	909.53–909.89	Grainstone	
459	909.89–910.87	Mudstone	
460	910.87–912.90	Mudstone-wackestone	Minor moldic porosity
461	912.90–913.20	Mudstone-wackestone	
462	913.20–913.80	Mudstone	
463	913.80–917.11	Packstone	Very porous; intraclasts (Core 97R)
464	917.11–917.75	Grainstone	
465	917.75–919.11	Floatstone	(Core 98R)
466	919.11–923.91	Wackestone	Very porous; limestone intraclasts; dissolution halos
467	923.91–924.53	Rudstone-grainstone	
468	924.53–928.43	Laminites	Clay-rich algal laminites with packstone intervals; moldic porosity at base of section
469	928.43–929.70	Grainstone	Intense dissolution 828.74–828.87
470	929.70–930.75	Packstone	Nodular texture
471	930.75–931.43	Grainstone	
472	931.43–931.95	Mudstone	Massive
473	931.95–932.40	Mudstone-wackestone	Small and large vugs; intraclasts
474	932.40–933.91	Packstone	Well-cemented interval 933.2
475	933.91–934.29	Mudstone	Finely bedded; clay seams
476	935.30–937.02	Packstone	Moldic porosity
477	937.02–937.48	Laminites	
478	937.48–938.25	Mudstone	Small vugs (< 1 cm)
479	938.25–940.47	Packstone	Large vugs (> 1 cm)
480	940.47–941.56	Packstone	Upper portion well-cemented and less vugular
481	941.56–942.95	Mudstone-wackestone	
482	942.95–946.74	Wackestone-mudstone	(Cores 100R, 101R)
483	946.74–948.53	Mudstone-wackestone	
484	948.53–949.19	Laminites	
485	949.19–949.44	Mudstone	Massive
486	949.44–949.93	Laminites	
487	949.93–951.76	Packstone	Moldic porosity
488	951.76–952.19	Mudstone	Minor moldic porosity
489	952.19–952.92	Laminites	
490	952.92–953.81	Wackestone-mudstone	
491	953.81–955.48	Packstone-wackestone	Grades upward to wackestone-packstone; moldic porosity
492	955.48–962.77	Packstone	Grades upward to mudstone-wackestone
493	962.77–964.68	Laminites	
494	964.68–965.28	Mudstone	
495	965.28–968.20	Packstone	Very porous at base; grades upward to mudstone
496	968.20–968.46	Mudstone	
497	968.46–968.54	Packstone	
498	968.54–969.23	Wackestone	Clay seam at 968.92 (Core 103R)
499	969.23–972.15	Packstone	Grades upward to packstone; extensive dissolution (Cores 103R, 104R)

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
500	972.15–976.88	Laminites	(Core 104R)
501	976.88–977.15	Wackestone	(Core 104R)
502	977.15–981.30	Packstone	Extensive dissolution at base of section
503	981.30–985.86	Wackestone-mudstone	Minor moldic porosity; limestone intraclasts (Core 105R) 984–985 interval predominantly mudstone
504	985.86–986.03	Laminites	
505	986.03–986.14	Mudstone-wackestone	
506	986.14–986.20	Laminites	
507	986.20–987.31	Mudstone-wackestone	Moldic porosity; intraclasts
508	987.31–988.88	Wackestone-mudstone	Mudstone interbeds
509	988.88–989.70	Packstone	Moldic porosity
510	989.70–990.77	Packstone	Intense dissolution
511	990.77–991.09	Wackestone-mudstone	
512	991.09–993.34	Wackestone-mudstone	Wackestone grading upward to mudstone; intraclasts at base
513	993.34–993.46	Mudstone	
514	993.46–996.55	Mudstone-wackestone	Intraclasts
515	996.55–998.77	Packstone	Numerous rounded intraclasts
516	998.77–999.37	Laminites	
517	999.37–999.56	Clay	Limestone intraclast
518	999.56–1000.85	Packstone	Porosity increases downsection
519	1000.85–1001.80	Wackestone-mudstone	
520	1001.80–1002.12	Laminites	
521	1002.12–1002.42	Mudstone	Massive
522	1002.42–1002.45	Clay	
523	1002.45–1002.60	Mudstone	
524	1002.60–1002.93	Wackestone	
525	1002.93–1003.27	Mudstone	
526	1003.27–1007.65	Packstone-wackestone	Packstone grading upward to wackestone; moldic porosity; extensive dissolution
527	1007.65–1009.38	Packstone-wackestone	Packstone grading upward to wackestone; moldic porosity; extensive dissolution
528	1009.38–1010.43	Laminites	
529	1010.43–1011.70	Wackestone	
530	1011.70–1012.07	Wackestone-grainstone	Interbedded wackestone and grainstone
531	1012.07–1013.52	Wackestone	Mudstone intraclasts; clay seam at 1012.07
532	1013.52–1014.52	Grainstone-wackestone	Clay seam at 1014.5
533	1014.52–1015.37	Wackestone	
534	1015.37–1015.52	Mudstone	Massive; low porosity
535	1015.52–1018.45	Packstone-wackestone	Bottom 0.4 m is wackestone, grading upward to packstone; Mudstone intraclasts (Core 108R)
536	1018.45–1022.68	Grainstone	Coarse grainstones grading upward to fine grainstone; mudstone rip-up clasts at base of section
537	1022.68–1023.86	Mudstone	Algal laminites and clay seams
538	1023.86–1025.20	Laminites-algal mat	Minor mudstone intervals
539	1025.20–1026.10	Laminites	
540	1026.10–1027.22	Mudstone	
541	1027.22–1032.82	Packstone	Moldic porosity; burrowed; intraclasts (Core 110R)
542	1032.82–1033.32	Packstone-algal mat	(Core 110R)
543	1033.32–1034.74	Wackestone-algal mat	Moldic porosity (Core 110R)
544	1034.74–1036.83	Laminites	Some wackestone; minor packstone at top of section (Core 110R)
545	1036.83–1039.60	Packstone-wackestone	Packstone grading upward to wackestone; moldic porosity; burrowed
546	1039.60–1042.08	Wackestone-packstone	Packstone grading upward to wackestone–grainstone; moldic porosity; intraclasts
547	1042.08–1042.78	Packstone-algal mat	
548	1042.78–1043.29	Laminites-algal mat	Graded bedding
549	1043.29–1044.54	Rudstone	
550	1044.54–1044.92	Wackestone-rudstone	
551	1044.92–1046.00	Mudstone	Some laminites; clay seam
552	1046.00–1051.83	Wackestone-mudstone	Wackestone grading upward to wackestone–mudstone; minor packstone (Core 111R)
553	1051.83–1053.86	Wackestone	
554	1053.86–1054.83	Packstone	Moldic porosity
555	1054.83–1055.71	wackestone	Moldic porosity
556	1055.71–1056.01	Laminites	
557	1056.01–1060.16	Wackestone-mudstone	Wackestone grading upward to wackestone-mudstone
558	1060.16–1062.00	Grainstone	
559	1062.00–1062.25	Packstone	(Core 113R)
560	1062.25–1065.02	Wackestone	
561	1065.02–1066.11	wackestone	Well-cemented
562	1066.11–1066.65	Laminites	Clay seams
563	1066.65–1067.47	Clay seams	With laminites
564	1067.47–1069.96	Wackestone	
565	1069.96–1070.87	Laminites	
566	1070.87–1072.10	Packstone-wackestone	Packstone grading upward to wackestone
567	1072.10–1072.46	Laminites	
568	1072.46–1073.27	Wackestone	
569	1073.27–1074.76	Packstone	
570	1074.76–1075.80	Wackestone	Clay seams (Core 114R)
571	1075.80–1076.25	Packstone	(Core 114R)
572	1076.25–1077.06	Laminites	
573	1077.06–1078.14	Mudstone	Clay-rich laminites
574	1078.14–1081.22	Packstone	Packstone grading upward to wackestone minor moldic porosity (Core 115R); clay seams
575	1081.22–1082.22	Wackestone	Clay seams
576	1082.22–1087.32	Packstone	
577	1087.32–1088.69	Packstone-wackestone	
578	1088.69–1090.00	Laminites	

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
579	1090.00–1096.04	Packstone-wackestone	Very coarse and vugular packstone at base, grading upward to wackestone
580	1096.04–1096.80	Laminites	(Core 116R)
581	1096.80–1097.20	Wackestone	
582	1097.20–1097.56	Laminites	
583	1097.56–1097.67	Wackestone	
584	1097.67–1098.07	Algal mat	With laminites
585	1098.07–1099.87	Wackestone	
586	1099.87–1100.34	Wackestone	Very well-cemented
587	1100.34–1100.67	Laminites	Clay seam
588	1100.67–1102.00	Laminites	
589	1102.00–1105.51	Packstone	(Core 117R)
590	1105.51–1107.30	Laminites	Clay seams (Core 117R)
591	1107.30–1107.63	Wackestone	
592	1107.63–1107.84	Laminites	Clay seam
593	1107.84–1108.40	Wackestone	
594	1108.40–1109.02	Laminites	
595	1109.02–1109.58	Packstone	Packstone interbedded with clay; minor moldic porosity
596	1109.58–1110.90	Packstone	Moldic porosity
597	1110.90–1111.45	Wackestone	
598	1111.45–1112.32	Packstone	
599	1112.32–1113.40	Laminites	Clay-rich intervals
600	1113.40–1114.50	Packstone	
601	1114.50–1115.46	Laminites	
602	1115.46–1117.09	Wackestone-packstone	Wackestone grading upward to packstone
603	1117.09–1118.02	Laminites	
604	1118.02–1118.85	Packstone	(Core 119R)
605	1118.85–1119.73	Laminites	
606	1119.73–1121.35	Grainstone	
607	1121.35–1122.55	Rudstone	
608	1122.55–1124.74	Mudstone-grainstone	Clay-rich intervals
609	1124.74–1126.80	Grainstone	Intraclast-rich interval (1125.1–1125.7)
610	1126.80–1127.30	Packstone-grainstone	
611	1127.30–1128.20	Laminites	
612	1128.20–1129.18	Grainstone	Well-cemented at base of section; moldic porosity
613	1129.18–1129.58	Mudstone	Massive
614	1129.58–1130.22	Packstone-grainstone	(Core 120R)
615	1130.22–1131.03	Grainstone	
616	1131.03–1131.61	Laminites	
617	1131.61–1133.01	Packstone	Minor moldic porosity
618	1133.01–1133.43	Mudstone	With algal mat
619	1133.43–1134.13	Wackestone	
620	1134.13–1135.07	Grainstone	
621	1135.07–1136.54	Packstone-grainstone	Moldic porosity
622	1136.54–1136.94	Wackestone	
623	1136.94–1137.53	Laminites	
624	1137.53–1137.93	Wackestone	Highly resistive; very well cemented or dolomitized
625	1137.93–1140.05	Wackestone-grainstone	Wackestone and grainstone interbeds; intraclasts (dolomite?)
626	1140.05–1142.01	Packstone	Intergranular porosity increases upsection; numerous intraclasts in upper half
627	1142.01–1142.54	Wackestone	Rounded intraclasts; large vugs
628	1142.54–1143.83	Laminites	Clay seam
629	1143.83–1144.55	Grainstone-wackestone	
630	1144.55–1146.30	Packstone-grainstone	Thin, well-cemented intervals
631	1146.30–1148.05	Grainstone-wackestone	
632	1148.05–1151.05	Grainstone-packstone	Grainstone grading upward to packstone
633	1151.05–1152.00	Packstone	Moldic porosity
634	1152.00–1152.50	Mudstone	Small vugs
635	1152.50–1154.20	Packstone	Moldic porosity; dolomitized
636	1154.20–1156.60	Grainstone	Moldic porosity
637	1156.60–1157.39	Dolomitized packstone	
638	1157.39–1157.70	Mudstone	
639	1157.70–1159.04	Laminites	
640	1159.04–1162.32	Packstone	
641	1162.32–1163.06	Mudstone	
642	1163.06–1163.44	Grainstone	
643	1163.44–1163.77	Mudstone	
644	1163.77–1165.04	Grainstone	Vertical fracture
645	1165.04–1165.57	Dolomite	
646	1165.57–1166.15	Grainstone	
647	1166.15–1166.75	Packstone	Partially dolomitized; clay seams
648	1166.75–1167.41	Wackestone	
649	1167.41–1168.60	Grainstone	
650	1168.60–1168.66	Clay	
651	1168.66–1169.28	Laminites	
652	1169.28–1171.43	Packstone-grainstone	Packstone grading upward to grainstone; dolomitized (Core 124R)
653	1171.43–1172.30	Grainstone	(Dolomite?) nodules
654	1172.30–1173.45	Wackestone-packstone	Wackestone grading upward to packstone
655	1173.45–1174.16	Grainstone	Wavy bedding; clay seam
656	1174.16–1176.40	Dolomitized packstone	
657	1176.40–1178.67	Packstone-grainstone	Dolomite nodules
658	1178.67–1184.02	Grainstone-laminites	Laminites interbedded with grainstones and clay seams; minor moldic porosity
659	1184.02–1185.20	Mudstone	Massive
660	1185.20–1186.63	Grainstone	Minor wackestone at base of section (Core 126R)
661	1186.63–1187.40	Grainstone	Clay seams
662	1187.40–1187.63	Packstone	
663	1187.63–1188.07	Wackestone	

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
664	1188.07–1193.52	Grainstone	Clay seams; minor packstone intervals; minor moldic porosity
665	1193.52–1195.41	Wackestone-mudstone	Porosity decreases upsection
666	1195.41–1197.55	Grainstones	Clay seams; minor packstone
667	1197.55–1198.48	Wackestone	
668	1198.48–1203.31	Wackestone-grainstone	Clay seams; intraclasts (Core 127R)
669	1203.31–1204.40	Grainstone-packstone	Laminite interbeds (Core 128R)
670	1204.40–1206.02	Dolomitized packstone	
671	1206.02–1207.71	Grainstone	Clay seams; minor moldic porosity; well-cemented
672	1207.71–1208.42	Wackestone-grainstone	Partially dolomitized; minor moldic porosity
673	1208.42–1209.06	Grainstone	Partially dolomitized
674	1209.06–1212.11	Wackestone	Dolomitized in lower portion
675	1212.11–1212.80	Grainstone	
676	1212.80–1214.47	Dolomite	Upper and lower portions retain some grainstone texture
677	1214.47–1216.42	Wackestone-grainstone	Clay seams; minor moldic porosity; lower 40 cm very well-cemented (Core 129R)
678	1216.42–1217.36	Dolomite	Some grainstone texture remains; clay seams
679	1217.36–1219.90	Grainstone-packstone	Clay seams; patchy dolomitization
680	1219.90–1221.16	Packstone	Dolomitized at base
681	1221.16–1221.67	Packstone-grainstone	
682	1221.67–1223.60	Grainstone	Dolomite burrow fillings
683	1223.60–1225.02	Mudstone	
684	1225.02–1225.88	Packstone-grainstone	Dolomitized
685	1225.88–1226.87	Packstone-rudstone	
686	1226.87–1228.67	Grainstone	Clay seams, laminite interbeds
687	1228.67–1229.47	Packstone	Moldic porosity
688	1229.47–1230.78	Wackestone	Clay seams, laminite interbeds
689	1230.78–1236.48	Grainstone	Laminated claystones and clay seams; minor moldic porosity; dolomitized
690	1236.48–1236.86	Wackestone	Patchy dolomitization (Core 131R)
691	1236.86–1237.19	Laminites	Laminated algal mat and clayseams
692	1237.19–1238.69	Grainstone-packstone	Clay seam
693	1238.69–1241.69	Packstone-grainstone	Clay laminites
694	1241.69–1242.96	Wackestone-grainstone	
695	1242.96–1244.21	Dolomite	Some grainstone texture remains; clay seam at top
696	1244.21–1244.54	Wackestone	(Core 132R)
697	1244.54–1246.20	Grainstone	Dolomitized; moldic porosity; intraclasts
698	1246.20–1247.78	Grainstone	Slightly dolomitized
699	1247.78–1247.96	Packstone	
700	1247.96–1250.50	Grainstone	Clay seams
701	1250.50–1252.40	Grainstone	Small-scale (< 1 cm) moldic porosity
702	1252.40–1253.44	Grainstone	Dolomitized
703	1253.44–1254.12	Packstone	Patchy dolomitization
704	1254.12–1258.27	Dolomite	Rudstone texture (Core 133R)
705	1258.27–1265.00	Dolomite	Rudstone texture; numerous intervals of compacted limestone with stylolites (Core 134R)
706	1265.00–1269.24	Wackestone	Dolomitized; vugular; largest vugs 4–5 cm
707	1269.24–1269.80	Dolomite	Moldic porosity; some grainstone texture remains
708	1269.80–1271.11	Wackestone	Stylolites
709	1271.11–1272.00	Dolomite	Some grainstone texture remains
710	1272.00–1273.29	Packstone-grainstone	Dolomitized; stylolites
711	1273.29–1274.50	Dolomite	Rudstone texture (Core 135R)
712	1274.50–1277.20	Packstone	Patchy dolomitization; stylolites
713	1277.20–1277.89	Dolomite	Very porous
714	1277.89–1280.60	Dolomite	Some grainstone texture remains
715	1280.60–1286.56	Wackestone	Numerous intraclasts; dolomite infillings
716	1286.56–1288.08	Dolomite	Relict grainstone texture
717	1288.08–1291.09	Dolomite	Wackestone-rudstone texture; vugular
718	1291.09–1292.60	Dolomite	Rudstone texture
719	1292.60–1293.72	Packstone	Patchy dolomitization
720	1293.72–1295.70	Dolomite	Rudstone texture
721	1295.70–1297.78	Wackestone	Partially dolomitized
722	1297.78–1303.15	Wackestone	Minor dolomitization within two vugular intervals
723	1303.15–1303.72	Wackestone	Partially dolomitized
724	1303.72–1307.12	Grainstone	Clay seams; 1304.0–1304.6 dolomitized (Core 138R)
725	1307.12–1308.11	Dolomite	
726	1308.11–1308.68	Grainstone	
727	1308.68–1310.16	Dolomite	Vugular
728	1310.16–1311.80	Packstone-grainstone	Dolomitized; clay seams
729	1311.80–1314.81	Grainstone	Thinly bedded (Core 139R)
730	1314.81–1315.24	Dolomite	
731	1315.24–1315.85	Wackestone-grainstone	
732	1315.85–1318.73	Dolomite	Minor intraclasts; vugular (Core 140R)
733	1318.73–1320.85	Grainstone	Partially dolomitized; numerous intraclasts; vugular (Core 140R)
744	1320.85–1330.49	Grainstone	Minor packstone; partially dolomitized
745	1330.49–1331.93	Dolomite	Relict grainstone texture (Core 141R)
746	1331.93–1337.83	Packstone	Dolomitized; highly vugular; highly variable porosity
747	1337.83–1341.38	Dolomite	Rudstone texture
748	1341.38–1343.59	Wackestone-grainstone	Partially dolomitized
749	1343.59–1345.64	Grainstone	Minor dolomitization; nodules of dolomite
750	1345.64–1345.80	Laminites-clay	
751	1345.80–1346.80	Grainstone	
752	1346.80–1346.90	Clay	
753	1346.90–1350.25	Grainstone	Well-sorted; variable dolomitization; numerous dolomite nodules
754	1350.25–1353.67	Dolomite	Vugular; relict grainstone texture at base of section
755	1353.67–1354.60	Grainstone	Partially dolomitized (Core 143R)
756	1354.60–1355.11	Dolomite	Rudstone texture
757	1355.11–1357.18	Grainstone-wackestone	
758	1357.18–1358.90	Grainstone	Dolomitized; minor dolomite nodules

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
759	1358.90–1359.25	Wackestone	
760	1359.25–1359.59	Laminites-clay	
761	1359.59–1361.26	Packstone	
762	1361.26–1361.35	Clay	
763	1361.35–1362.77	Wackestone	Minor moldic porosity; intraclasts
764	1362.77–1363.20	Grainstone	Well-sorted
765	1363.20–1363.50	Clay-laminites	
766	1363.50–1364.10	Grainstone	Well-sorted (Core 144R)
767	1364.10–1364.40	Marl	Clay seam at base of section (Core 144R)
768	1364.40–1366.09	Grainstone	(Core 144R)
769	1366.09–1367.18	Wackestone	Dolomitization increases downsection
770	1367.18–1372.00	Dolomite	Clay seam 1368.14
771	1372.00–1373.00	Packstone–grainstone	
772	1373.00–1373.60	Dolomite	Relict grainstone texture
773	1373.60–1374.17	Packstone-grainstone	
774	1374.17–1375.04	Dolomite	Rudstone texture
775	1375.04–1376.12	Mudstone	Finely laminated clay-mudstone intervals
776	1376.12–1376.22	Clay	
777	1376.22–1379.07	Packstone-grainstone	Clay seam 1377.65
778	1379.07–1379.88	Dolomite	Stylolites
779	1379.88–1380.22	Packstone-grainstone	
780	1380.22–1381.47	Mudstone	Prominent stylolites (Core 146R)
781	1381.47–1381.54	Clay	
782	1381.54–1384.96	Mudstone-grainstone	Stylolites
783	1384.96–1386.49	Grainstone	Numerous clay seams
784	1386.49–1388.60	Packstone-grainstone	Dolomitized; rudstone texture at base of section
785	1388.60–1393.66	Grainstone	Clays and laminite plentiful in interval 1392.8–1393.66; minor packstone interval 1391.2–1391.6
786	1393.66–1394.90	Wackestone-mudstone	Flaser bedding at base of section (Core 147R)
787	1394.90–1397.72	Grainstone-mudstone	Uniform porosity; numerous clay seams (Core 147R)
788	1397.72–1398.84	Dolomite	Rudstone texture
789	1398.84–1399.36	Packstone	
790	1399.36–1400.31	Wackestone	Minor clay seams
791	1400.31–1403.13	Mudstone-grainstone	Numerous clay seams; anastomosing clay seams at 1401.2
792	1403.13–1404.12	Mudstone-grainstone	Pebbles at base of section
793	1404.12–1406.04	Grainstone	Thinly bedded; upward-fining; clay seams
794	1406.04–1408.00	Packstone-rudstone	
795	1408.00–1409.80	Packstone-grainstone	
796	1409.80–1410.40	Grainstone	Well-sorted (Core 149R)
797	1410.40–1420.16	Grainstone	Intervals of clay and mudstone; moldic porosity; variable porosity
798	1420.16–1423.00	Grainstone	Well-sorted; moldic porosity increases downsection; intraclasts at base of section (Core 150R)
799	1423.00–1427.83	Grainstone	Variable porosity and grain size; minor clay seams; intraclasts (Core 150R)
800	1427.83–1429.34	Grainstone	Well-sorted
801	1429.34–1441.20	Grainstone	Variable porosity and grain size; clay seams and intraclasts more prominent downsection
802	1441.20–1441.84	Grainstone	Well-sorted (Core 152R)
803	1441.84–1443.90	Grainstone	Dolomitized (Core 152R)
804	1443.90–1444.80	Grainstone	Dolomitized; clay seams; intraclast-rich intervals (Core 152R)
805	1444.80–1447.00	Grainstone	Partially dolomitized (Core 153R)
806	1447.00–1449.14	Grainstone	Thinly bedded (Core 153R)
807	1449.14–1450.18	Grainstone	Clay seams (Core 153R)
808	1450.18–1454.28	Grainstone	Dolomitized; dolomite infillings
809	1454.28–1454.66	Dolomite	Rudstone texture
810	1454.66–1456.50	Dolomite	Relict grainstone texture
811	1456.50–1475.85	Dolomite	Rudstone texture
812	1475.85–1458.60	Dolomite	Packstone-rudstone texture
813	1458.60–1461.42	Dolomite	Vugular
814	1461.42–1463.80	Packstone	Minor wackestone
815	1463.80–1464.68	Dolomite	Vugular
816	1464.68–1465.27	Packstone	
817	1465.27–1465.76	Mudstone	
818	1465.76–1467.00	Dolomite	Vugular
819	1467.00–1473.65	Dolomitized grainstone	Degree of dolomitization highly variable
820	1473.65–1480.91	Grainstone-rudstone	Moldic porosity; dolomite-filled burrows (1475.4); minor stylolites
821	1480.91–1482.66	Dolomite	Rudstone texture
822	1482.66–1505.88	Grainstone	Variable dolomitization; stylolites; rare clay seams
823	1505.88–1508.20	Grainstone-mudstone	Well-cemented; moldic porosity at 1506.4
824	1508.20–1512.96	Dolomite	Relict texture similar to bed 823
825	1512.96–1514.86	Wackestone	Minor moldic porosity
826	1514.86–1520.43	Dolomite	Rudstone-grainstone texture; stylolites; dolomitization increases downsection
827	1520.43–1521.38	Dolomite	Extremely porous
828	1521.38–1522.02	Wackestone	Well-cemented; moldic porosity
829	1522.02–1522.58	Clay-laminites	
830	1522.58–1525.82	Packstone-wackestone	Patchy dolomitization; moldic porosity
831	1525.82–1527.64	Grainstone	Dolomitized
832	1527.64–1529.55	Dolomite	Very porous
833	1529.55–1534.35	Dolomite	Relict grainstone texture intraclasts; well-cemented interval (1531.6)
834	1534.35–1534.80	Mudstone(?)	Well-cemented; stylolites
835	1534.80–1537.60	Dolomite	Rudstone texture
836	1537.60–1541.19	Grainstone	Dolomitized; alternating well-cemented and porous intervals; porous intervals show intergranular and vugular porosities
837	1541.19–1545.03	Dolomite	Rudstone texture; vertical fluid escape channels; large cavity 1542.4–1542.8
838	1545.03–1557.20	Dolomite	Relict grainstone texture
839	1557.20–1560.00	Mudstone	Dispersed organic matter

Table 2 (continued).

Bed number	Depth range (mbsf)	Lithology	Description
	1560.00–1565.00	Data section missing	
840	1565.00–1569.58	Dolomite	Rudstone texture
841	1569.58–1572.65	Grainstone	Dolomitized; intervals of moldic porosity; stylolites
842	1572.65–1574.79	Wackestone	
843	1574.79–1578.44	Grainstone	Dolomitized; high intergranular and vugular porosities
844	1578.44–1582.50	Grainstone	Slightly dolomitized; mudstone intervals and clay seams
845	1582.50–1586.40	Grainstone	Dolomitized; high intergranular porosity; clay seams; anastomosing clay seams 1585.0
846	1586.40–1588.00	Grainstone	Dolomitized
847	1588.00–1589.76	Dolomite	Rudstone texture
848	1589.76–1590.60	Dolomite	Packstone-rudstone texture
849	1590.60–1591.95	Mudstone	
850	1591.95–1596.03	Mudstone-grainstone	
851	1596.03–1597.04	Mudstone	Stylolites
852	1597.04–1597.93	Dolomite	Rudstone texture
853	1597.93–1599.20	Mudstone	Stylolites
854	1599.20–1623.80	Mudstone-grainstone	Mudstone with stylolites; grainstones highly variable porosity; clay intervals (1600.0, 1601.8, 1603.0); intraclasts 1610.7–1612.4; dolomitization increases downsection

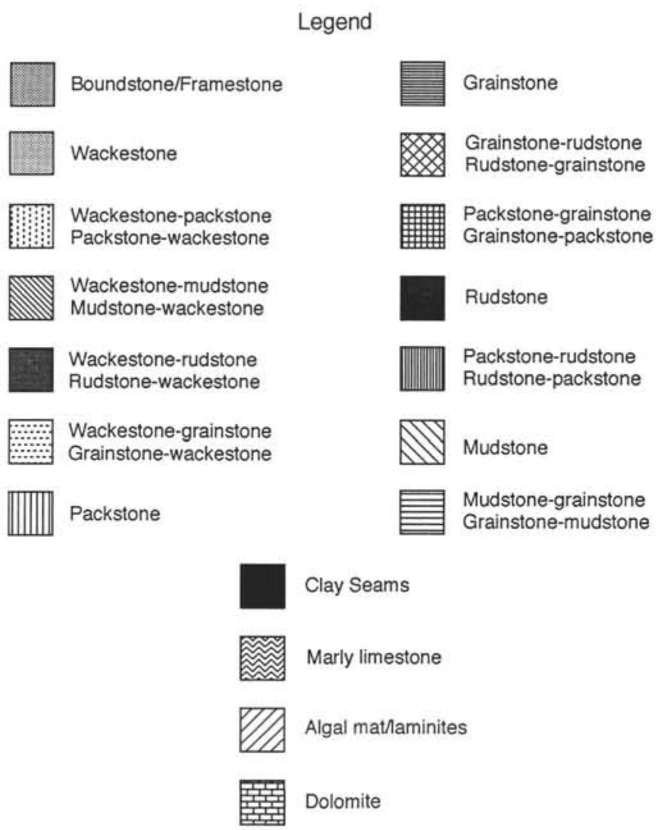


Figure 8. Legend of patterns used to designate lithologies in Figures 9 and 10.

able width are not visible in the FMS images above about 657 mbsf; however, thin (below resolution) clay seams may have caused the stratification observed in the mudstones and wackestones-mudstones beginning at 603 mbsf. Concentrations of clay seams appear to be spaced at 20- to 50-cm intervals in the recovered core, but are spaced farther apart in the FMS images; again, probably because some thicknesses are below the resolution of the FMS tool. Clay seams may be the result of autocyclic processes, such as changing influx paths for terrigenous material or allocyclic fluctuation of sea level, rainfall intensity, carbonate production, or some combination of these (e.g., James, 1989).

Although the depth interval from 600 to 835.5 mbsf also consists of sequences of packstone, wackestone, and mudstone, the relatively greater abundance of mudstones, clay seams, and marls indicates a more restricted lagoonal setting. Grainstone intervals are rare and together with occurrences of rare planktonic species in the core material are probably the result of occasional washover.

In summary, the sedimentary record of Allison Guyot shows small-scale, shallow-water carbonate sequences of (late) Albian age. Facies imply a clay-, organic-, and pyrite-rich, marshlike environment with a nearby volcanic landmass in the lower part of the hole, and restricted, lagoonal settings in its upper part, similar (but not identical) to the Albian section at Hole 866A. The absence of clays above 600 mbsf suggests an expanding lagoon and submergence of the volcanic edifice.

SUMMARY OF LOG–CORE INTEGRATION FOR HOLE 866A

The depth interval from 206 to 466 mbsf consists of sediments derived from a restricted, shallow, subtidal inner shelf. From 206 to 346 mbsf, rudstones and wackestone-packstone sequences are common, with minor mudstone and grainstone. Extensive dissolution is evident at the base of this pile, indicating possible emergence and erosion of the platform. The mudstone-rudstone-wackestone facies common throughout the interval from 346 to 351 mbsf probably indicate a upward-deepening transition. Wackestones, packstones, and especially mudstones are common throughout the depth interval from 351 to 449 mbsf. Another upward-deepening transition is indicated by the packstones and marls that occur within the depth interval from 449 to 466 mbsf.

Tidal flats typified the depositional environment of sediments from the depth interval from 466 to 692 mbsf. The major lithologies consist of wackestone-packstone alternations with scattered abundant grainstones. Several distinct intervals can be distinguished on the basis of the presence or absence of grainstone or mudstone: from 466 to 479 mbsf, wackestone-packstone, grainstones abundant (slight progradation); 479 to 528 mbsf, wackestone-packstone, no mudstones; 528 to 543 mbsf, wackestone-packstone, grainstones abundant (slight progradation); 543 to 587 mbsf, wackestone-packstone, some grainstone and rudstone (period of maximum flooding; aggradation); 587 to 648 mbsf, wackestone-packstone, grainstones abundant (slight progradation); clay seams at 587 to 590 mbsf; 648 to 676 mbsf, wackestone-mudstone and laminites (inner platform facies; aggradation); from 676 to 692 mbsf is a transition facies, wackestone-mudstone, rudstone, grainstone (possibly a late highstand stage).

Deepening occurs upward over the interval from 692 to 798 mbsf. The grainstones recovered within the interval from 692 to 791 mbsf reflect a foreshore environment during a highstand stage. The basal contact with underlying well-cemented mudstone is sharp. Slight backstepping is indicated by the mudstones of from 791 to 798 mbsf.

Table 3. Bed thickness statistics for Holes 865A and 866A.

	Hole 865A									
	Wackestone	Packstone	Packstone -wackestone	Mudstone	Mudstone-wackestone	Grainstone	Rudstone	Clay	Marl	Laminite
Min.	0.09	0.08	0.34	0.09	0.32	0.13	****	0.05	0.43	****
Max.	5.55	35.98	8.73	4.26	16.08	7.74	****	1.05	2.76	****
Sum	22.56	349.01	59.37	15.26	198.88	22.18	****	2.13	11.23	****
No.	19	92	26	22	87	10	****	7	7	****
Mean	1.19	3.79	2.28	0.69	2.29	2.22	****	0.30	1.60	****
%	3	51	8	2	29	3	****	<1	2	****

	Hole 866A										
	Wackestone	Packstone	Packstone -wackestone	Mudstone	Mudstone-wackestone	Grainstone	Rudstone	Clay	Marl	Laminite	Dolomite
Min.	0.03	0.08	0.15	0.09	0.11	0.10					0.38
	0.09	0.02	****	0.06							9.64
Max.	5.96	7.52	6.04	3.40	16.64	24.60	7.93	1.32	****	4.73	171.28
Sum	1113.73	272.95	136.34	49.4	103.69	339.32	122.48	5.12	****	45.96	75
No.	108	149	81	64	46	167	70	21	****	51	2.28
Mean	1.05	1.83	1.68	0.77	2.25	2.03	1.75	0.24	****	0.90	13
%	8	20	10	4	8	25					
	9	<1	****	3							

The strata deeper than 798 mbsf reflect the initial emergence and later flooding of the carbonate platform. The general flooding of the platform and evolution of a tidal-flat environment are revealed in the sediments of the interval from 798 to 1144 mbsf. From 798 to 853 mbsf, sediments are lagoonal (restricted shallow subtidal to intertidal) in origin (i.e., wackestone-packstone intervals with much clay). Algal mat disappears at top of this section, indicating a lowstand stage. The grainstones, abundant wackestone, and rudstone of the depth interval from 853 to 932 mbsf indicate a highstand stage, with maximum flooding at about 890 mbsf. From 932 to 1144 mbsf, mudstone, packstone, laminites, and clay reflect a restricted and shallow intertidal to supratidal environment. A grainstone at 1018 mbsf having ripup clasts at its base (visible in the FMS image) is probably a storm deposit; similarly, other minor grainstones in this interval are probably washover.

The depth interval from 1144 to 1442 mbsf consists of shallow subtidal to intertidal facies showing a general shallowing upward of the platform. These facies are dolomitized. From 1144 to 1244 mbsf, wackestone-packstone sequences and abundant grainstone intervals indicate alternating progradation and aggradation. Throughout the interval from 1244 to 1442 mbsf, common grainstone with abundant wackestone-packstone indicate a highstand stage.

Two major intercalations of oolitic limestone are developed, one of latest Hauterivian age (Jenkyns et al., this volume), which rests on the basaltic edifice, and a second of Aptian age (Sager, Winterer, Firth, et al., 1993; Jenkyns et al., this volume) that is sandwiched between lagoonal-peritidal sediments (692–798 mbsf). The Hauterivian coarse, unsorted grainstones at the base of the section (>1442 mbsf) were deposited on an open-marine shelf or ramp.

In summary, FMS and geophysical logs of porosity and porosity-related parameters (Fig. 10) confirm that the sedimentary record is composed of approximately 1- to 10-m sequences. Where resolution is good, smaller-scale sequences can be defined in the FMS logs, as well; often, however, the contrast is insufficient to identify them properly. These sequences are well developed at this site in the platform interior, where they probably reflect the cyclic deepening and shallowing of the depositional environment. From the lithostratigraphic interpretation of the logs and core information, we hypothesize that sediments of the upper 600 mbsf of Hole 866A originated in a somewhat restricted, tidal or subtidal environment, with oxygenated waters suitable for supporting a varied fauna. The predominant lithologies are upward-fining packstone-wackestone-mudstone sequences that have some significant grainstone intervals. Strasser (this volume) suggests a potential hiatus or condensed section at 480 mbsf, based on occurrence of calcrete horizons; the FMS logs place these horizons at a slightly different depth, about 465 mbsf. From about 600 mbsf downward, lithologies indicate a restricted lagoonal environment, punctuated by intervals of slightly more open lagoonal environment of up to 100 m thick (750–850, 880–930, 1180–1230, and 1260–1340 mbsf). Normal open-marine conditions prevail below 1340 mbsf.

COMPARISON OF ALBIAN SECTIONS AT SITES 865 AND 866

Beds for sections of Albian age were grouped into upward-fining (e.g., packstone-wackestone-mudstone) or upward-coarsening sequences. A plot of the thicknesses of upward-fining sequences vs. their centered depths (halfway between base and top) for both holes is shown in Figure 11. The plots should be regarded as qualitative and are not meant to provide the basis for a quantitative comparison; some beds contain numerous interbeds of clay or laminite, indicating numerous minor cycles, for example, and no attempt was made to measure beds thinner than 1 cm. Cycle thicknesses for Hole 865A are generally greater than those for Hole 866A; this is in agreement with the greater sedimentation rates suggested for Hole 865A (Sager, Winterer, Firth, et al., 1993). The thickest sequence measured for Hole 865A, located from 364.1 to 409.2 mbsf (packstone grading up to wackestone with extreme moldic porosity), is close in depth to that of Hole 866A, 411.9 to 442.0 mbsf (packstone grading up to mudstone with extreme moldic porosity). Could these two sequences be equal in time, especially because sequences above this level are generally longer for both holes, and sequences below this level are generally shorter for both holes? Evidence in support of this contention is found in logging "events" at corresponding depths at both sites. These events consist of high-amplitude excursions from prevailing values, usually in the resistivity log, occasionally seen in the natural gamma-ray log. At Site 865 (Fig. 9), such events occur at 240, 272, 305, and 320 mbsf, whereas at Site 866 (Fig. 10), similar events occur at 280, 325, 350, and 363 mbsf. Thus, deposition of the lagoonal sediments that make up the Albian section at Sites 866 and 865 probably overlapped somewhat. If this is the case, then, from Figure 11, it appears that much of the late Albian section above the 400-mbsf level is missing at Hole 865A, perhaps removed as the guyot emerged above sea level. At Hole 866A, a hiatus probably exists at the base of the Albian section (Strasser, this volume).

CONCLUSIONS

Deep holes drilled into the Cretaceous lagoonal facies of Allison (Site 865) and Resolution (Site 866) guyots yielded samples of thick sections of shallow-water limestones that record the histories of the

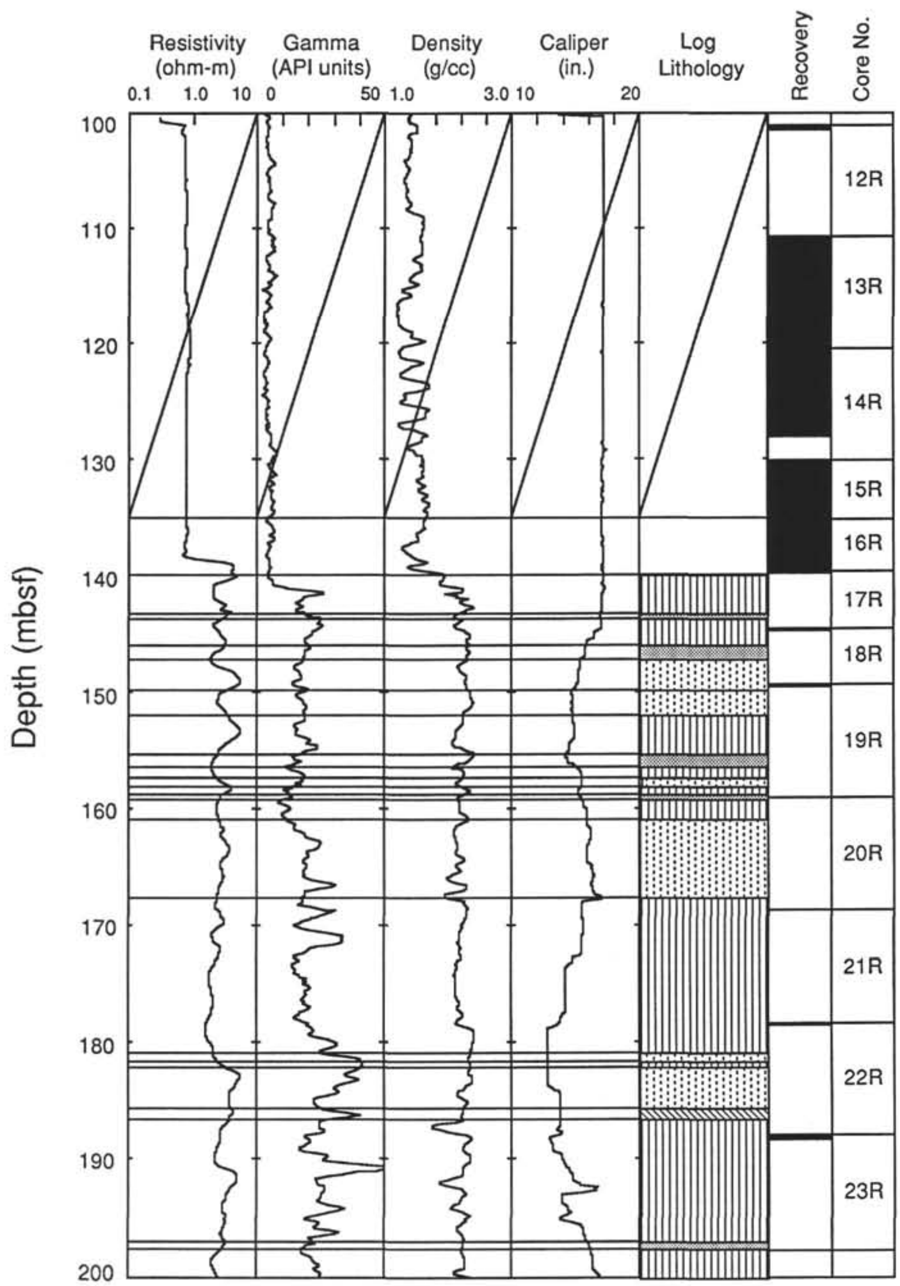


Figure 9. Profiles of (from left) medium electrical resistivity (ILM), natural gamma-ray intensity (NGT), formation density (RHOB), and caliper (HLDT), determined from downhole logs at Hole 865A. Cored intervals and recovery (in black) are shown in the right columns. The exact position of the cored material within the cored intervals is not constrained; recovered core material was pushed to the top of each cored interval for consistency. Also shown are lithologic interpretations based on integration of the FMS and geophysical logs with core descriptions; the pattern legend is shown in Figure 8.

guyots from initial submergence of the volcanic pedestal through the final drowning of the carbonate platform. However, core recovery was poor, and we suspect that not all lithologies were sampled and, further, that studies of widely spaced core samples would not provide a sufficiently detailed record of the vertical trajectories of the guyots for correlating directly between them. As downhole logs provide a more continuous record of the physical properties of the borehole, the integration of logging data with core descriptions presents a lithologic record that is both detailed and accurate.

Facies that evoked similar electrical responses in the conventional and FMS logs were calibrated using laboratory descriptions and photographs of recovered core materials to produce "type" examples for the various carbonate facies. The type examples then were used to convert the remaining logging data into lithologic columns. We saw immediately that core recovery at both sites was highly preferential (e.g., within the alternating packstone-wackestone intervals, only small pebbles of well-cemented wackestone were recovered). This study indicated that packstone was the dominant lithology (51%) at Hole 865A, and that grainstone (25%) and packstone (20%) were the dominant lithologies at Hole 866A (excluding dolomite). Recovery of packstone and grainstone was poor.

The sedimentary record from Allison Guyot, as determined from core-log integration, confirmed the existence of numerous small-scale shallow-water carbonate sequences of (late) Albian age. Facies from the lower part of the hole imply a clay- and organic-rich, marshy environment with a nearby landmass, gradually opening uphole into

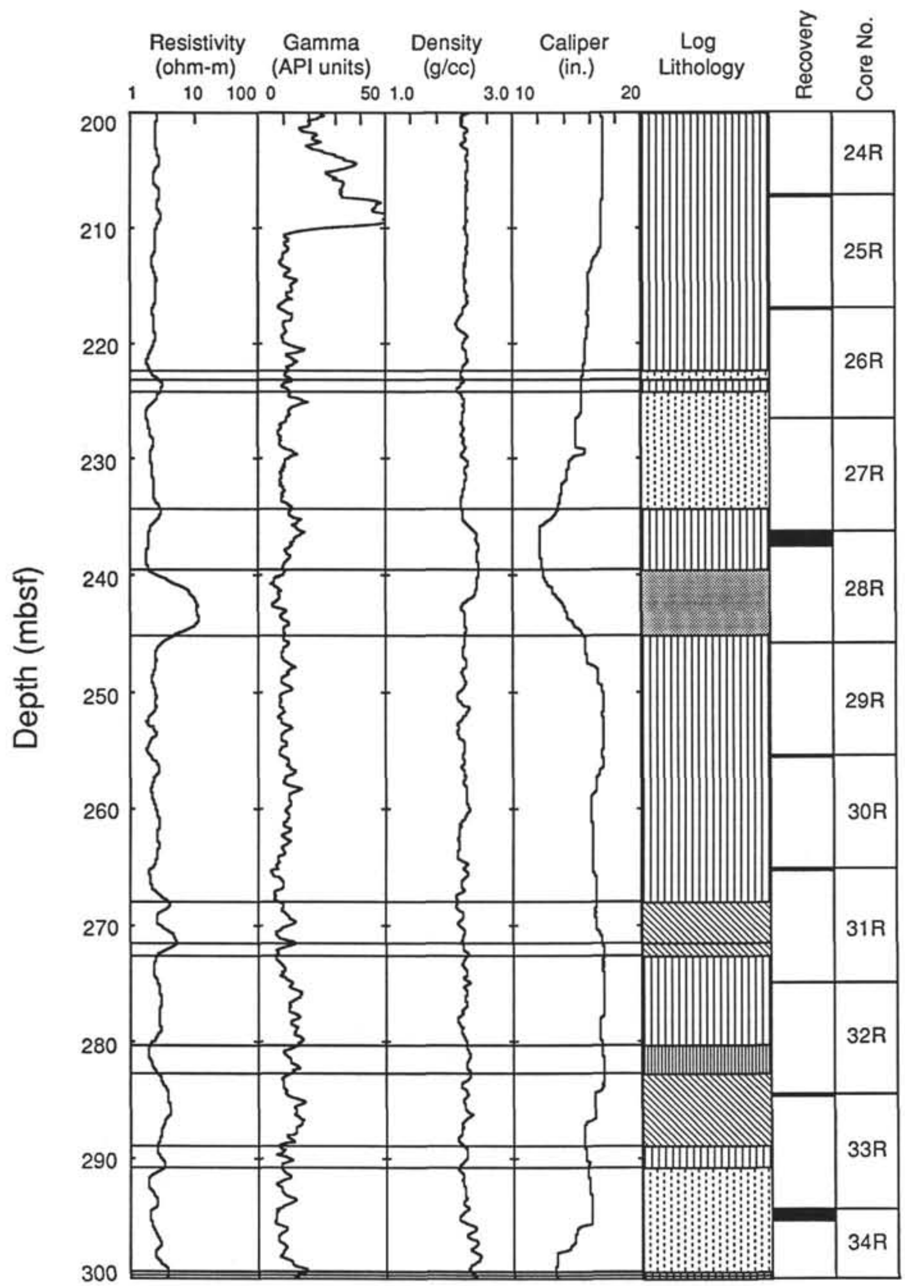


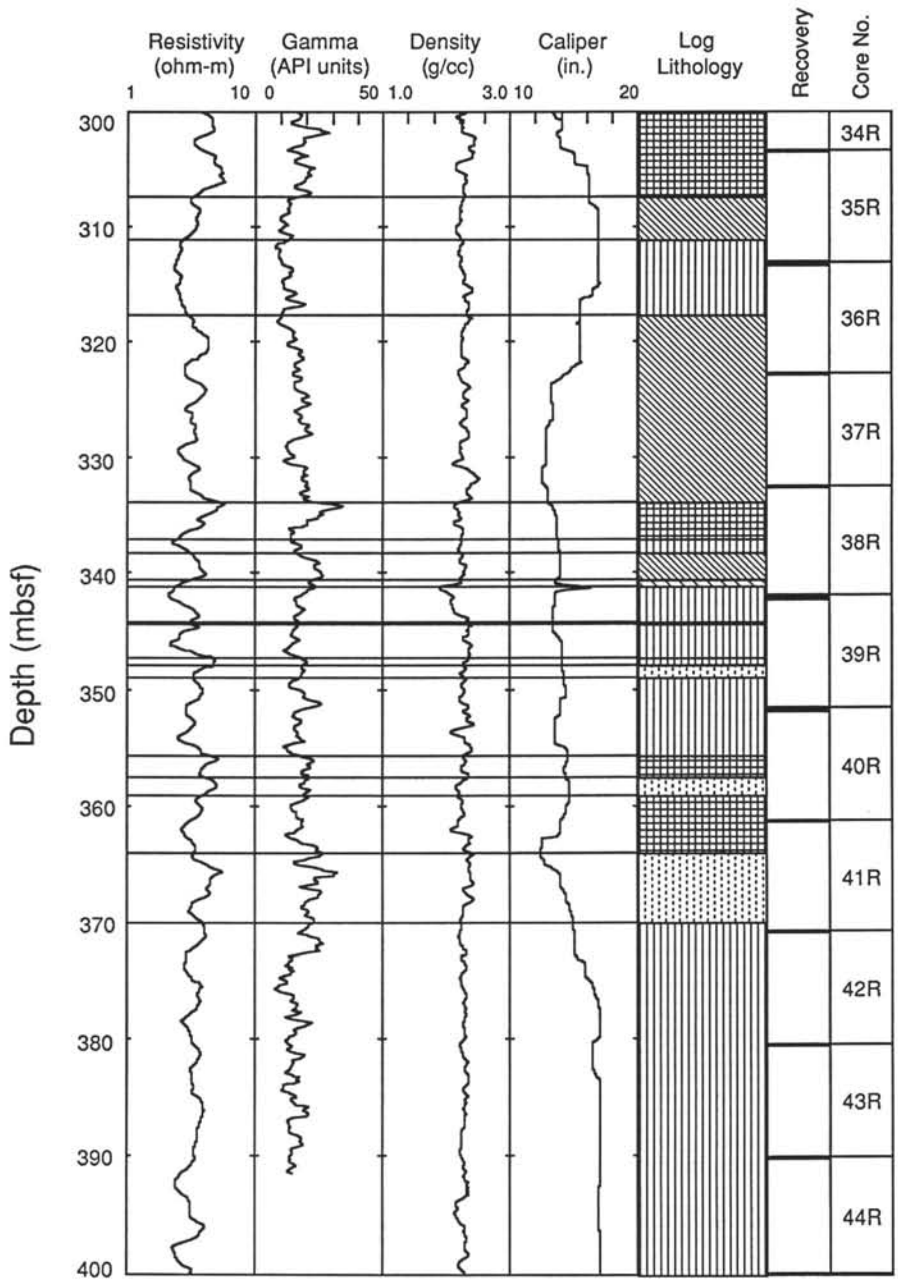
Figure 9 (continued).

a somewhat restricted lagoonal setting, similar to the Albian (200–550 mbsf) section at Hole 866A.

Quality of logs was better at Resolution Guyot because of better hole conditions. The sedimentary record at Hole 866A was composed of sequences 1 to 10 m long. Where resolution was particularly good, smaller-scale sequences could be defined in the FMS logs as well, although the contrast was often insufficient to identify them properly. Sediments in the upper 600 mbsf of Hole 866A originated in a somewhat restricted tidal or subtidal environment. Lithologies at depths greater than 600 mbsf imply a restricted lagoonal environment with occasional periods of more open lagoonal conditions. Lithologies below 1340 mbsf suggest normal open-marine conditions.

Lithologies were grouped into upward-fining sequences at both localities.

Sequence thicknesses for Hole 865A generally are greater than those for Hole 866A; this is in agreement with the greater sedimentation rates suggested for Hole 865A (Sager, Winterer, Firth, et al., 1993). The thickest sequence measured for Hole 865A, located at 364.1 to 409.2 mbsf (packstone grading upward to wackestone with extreme moldic porosity), corresponds in depth to that of Hole 866A at 411.9 to 442.0 mbsf (packstone grading upward to mudstone with extreme moldic porosity). Support for this contention is found in the existence of several smaller-scale, but significant, logging "events" found at similar depths in both holes. At both sites, this thick sequence defines a change in either depositional style or subsidence rate as sequences above this level are generally thicker, and sequences below this level are generally thinner, for both holes. This study supports Strasser's conclusion (this volume) that a hiatus probably exists near the Albian/Aptian boundary (~480 mbsf). Correlations of bed thicknesses and logging signatures between the two holes indicate that much of the Albian section may have been removed from Allison Guyot as it emerged above sea level.



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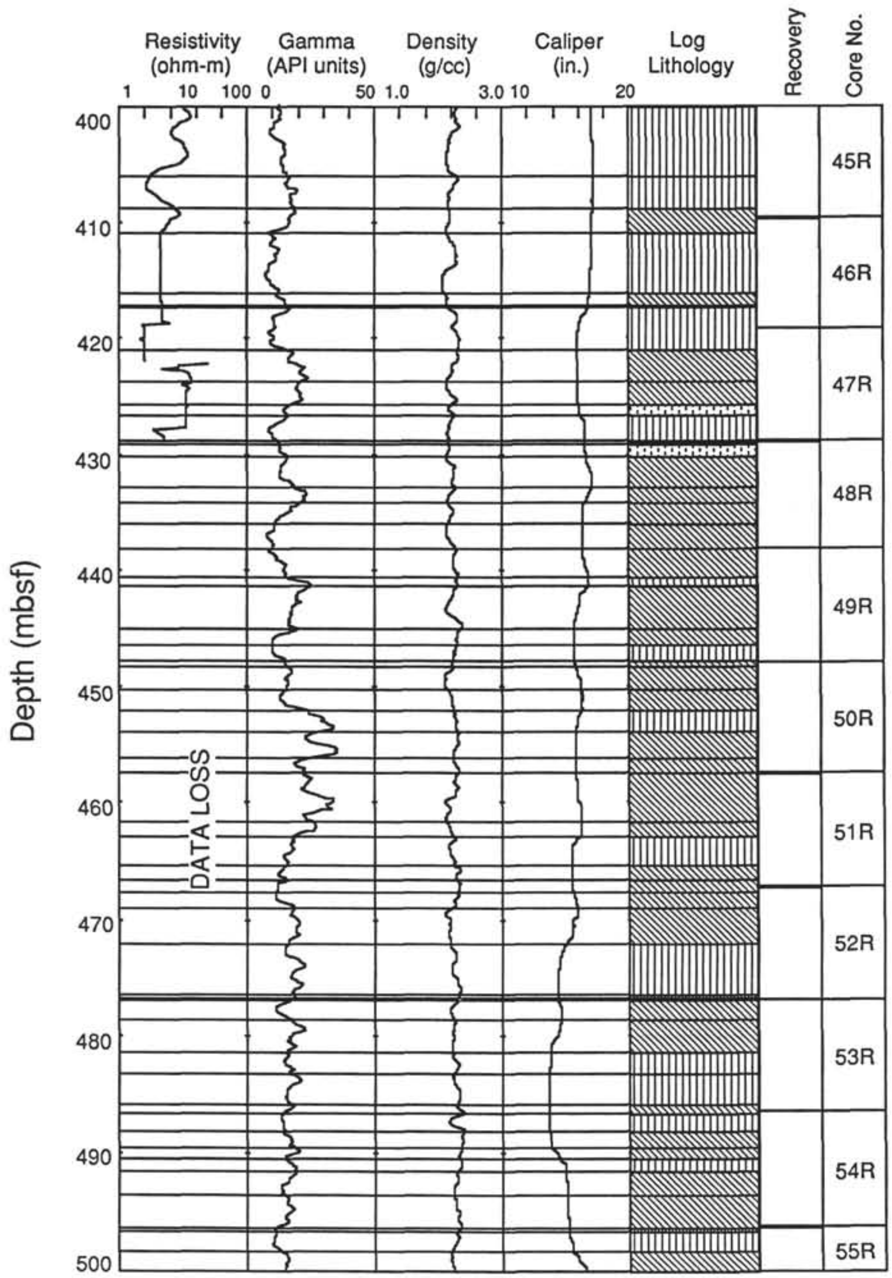

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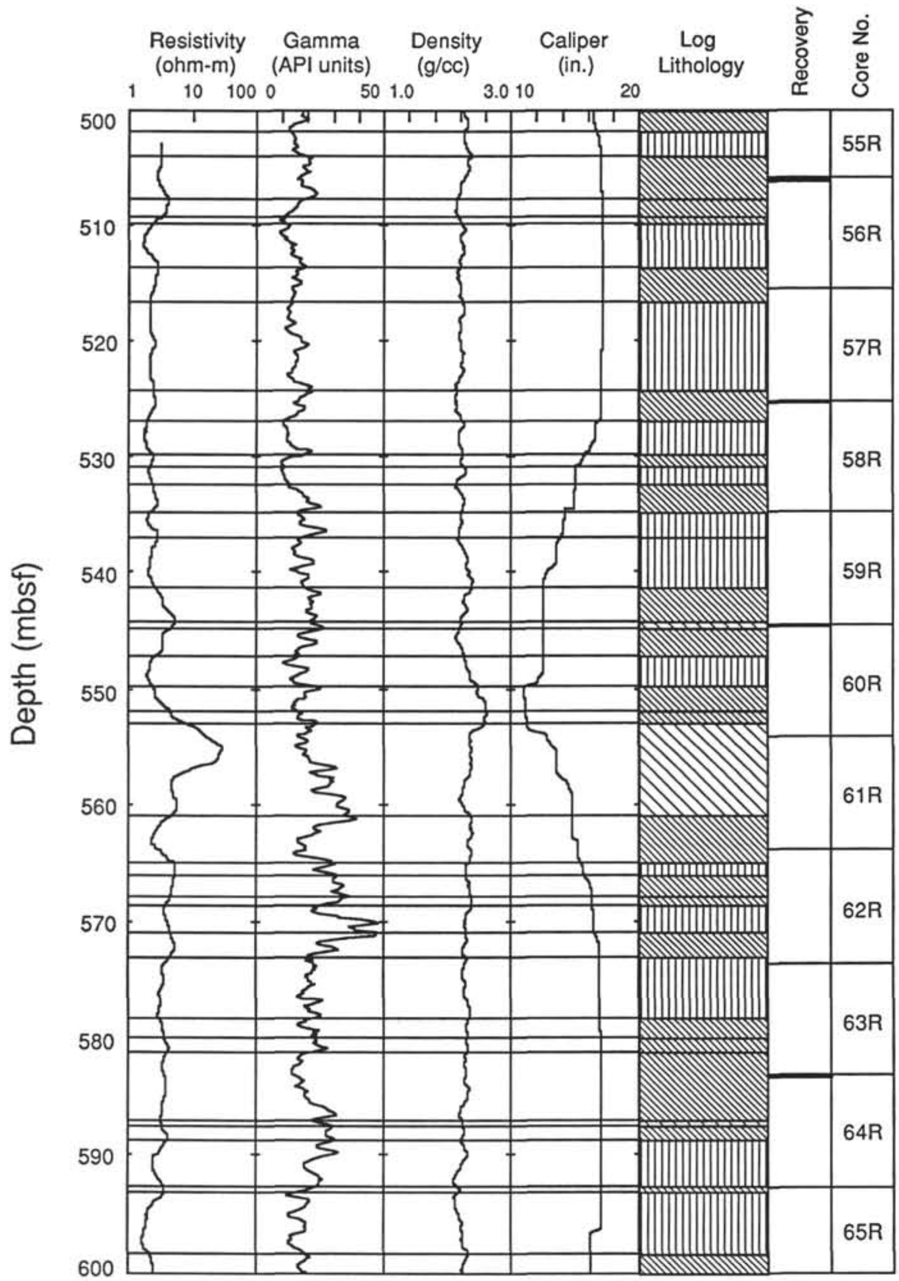

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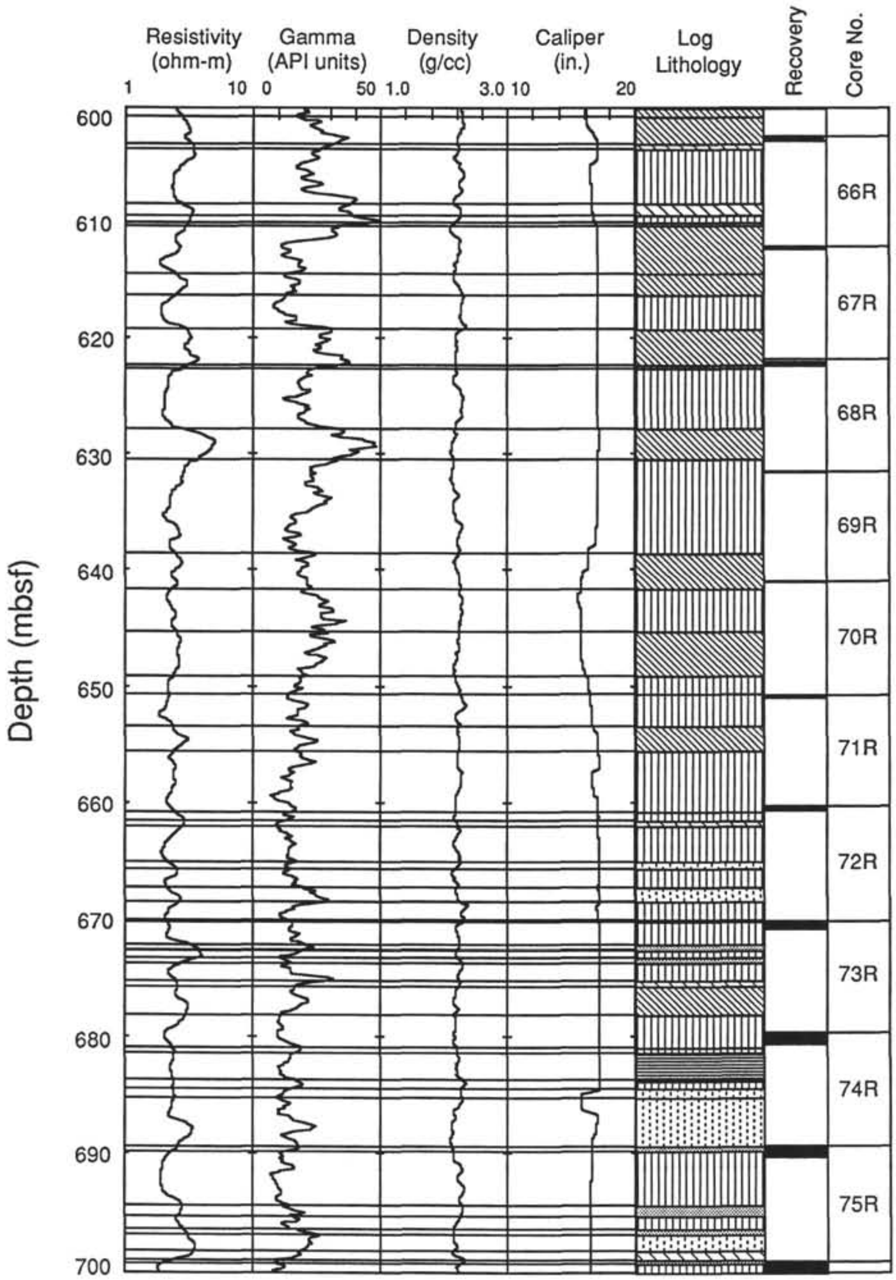

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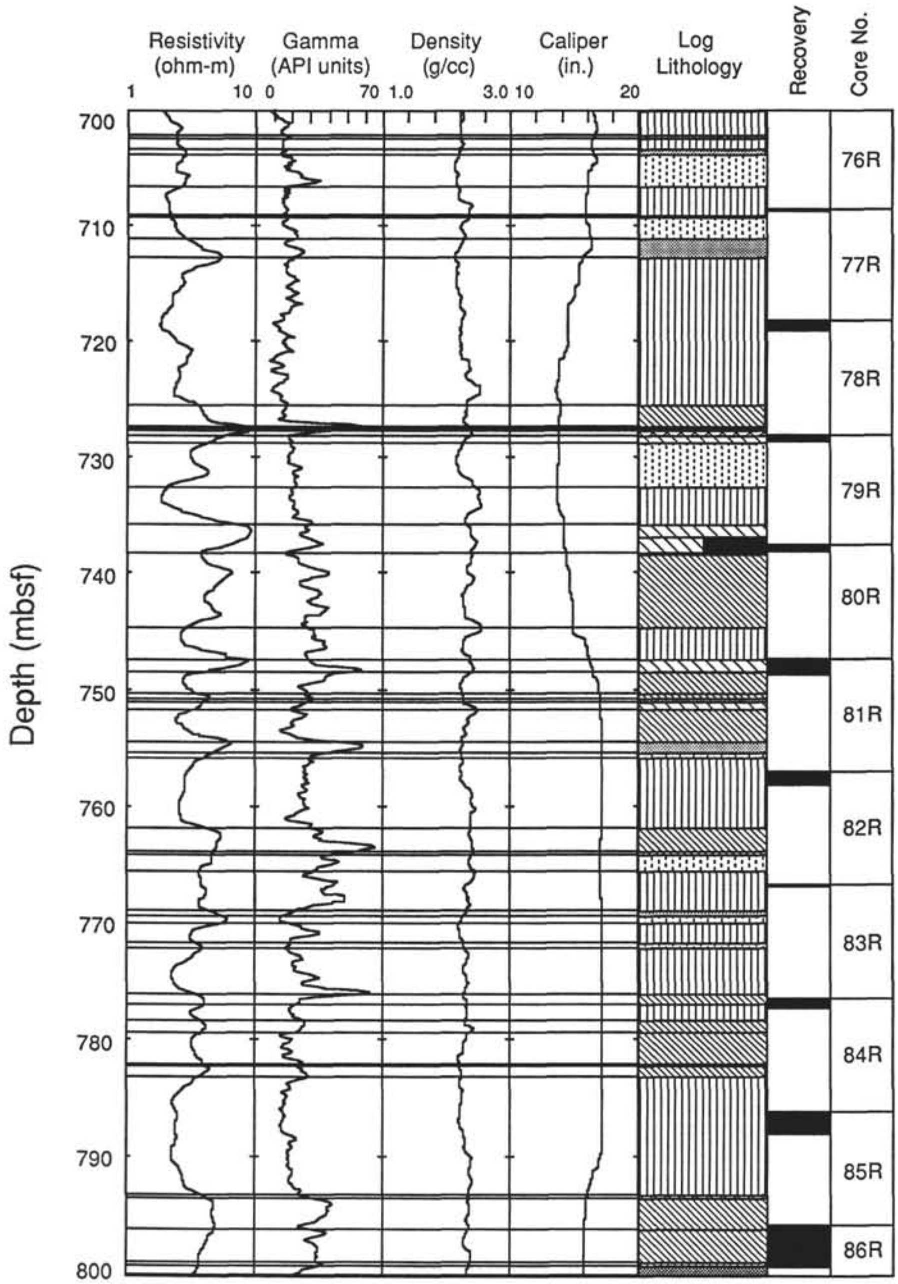

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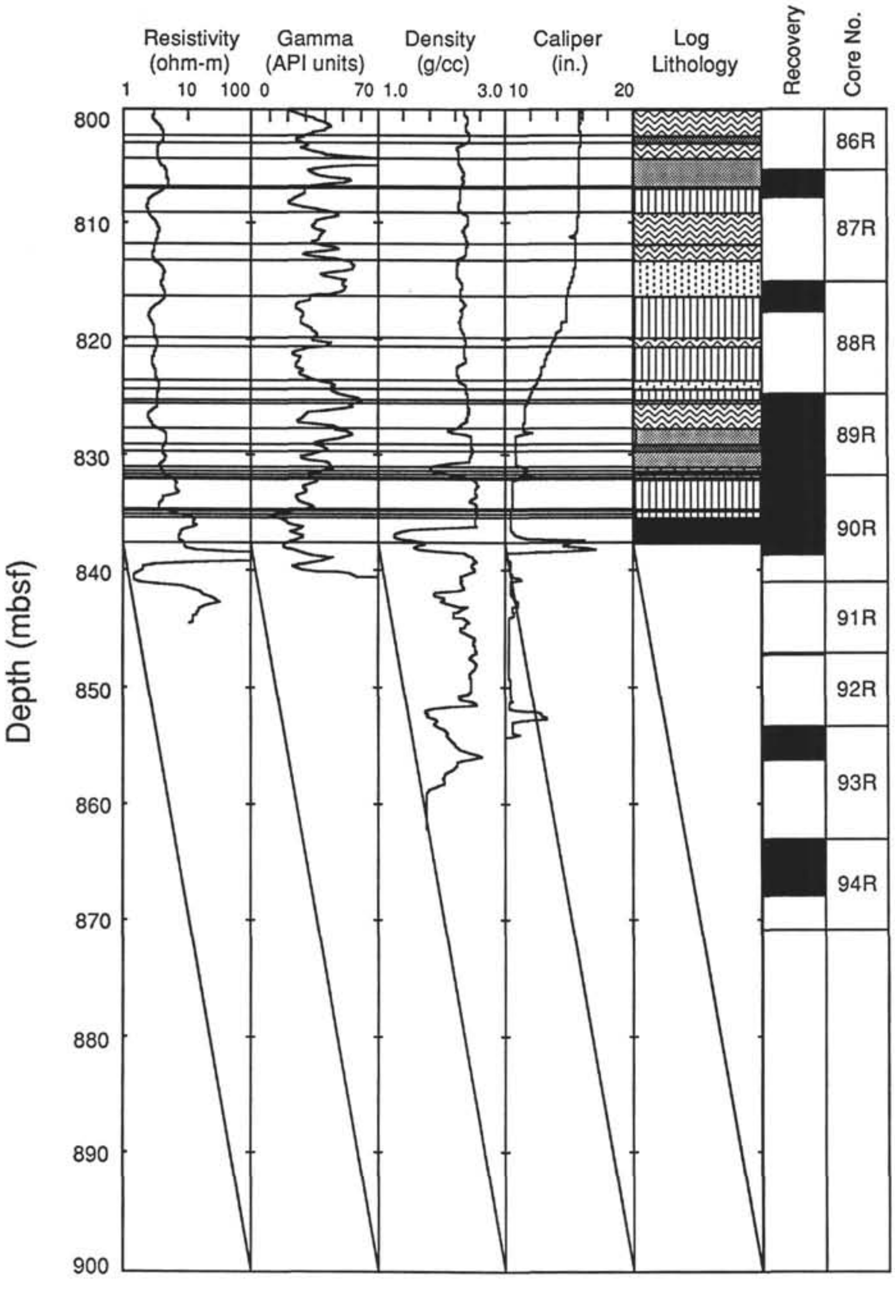

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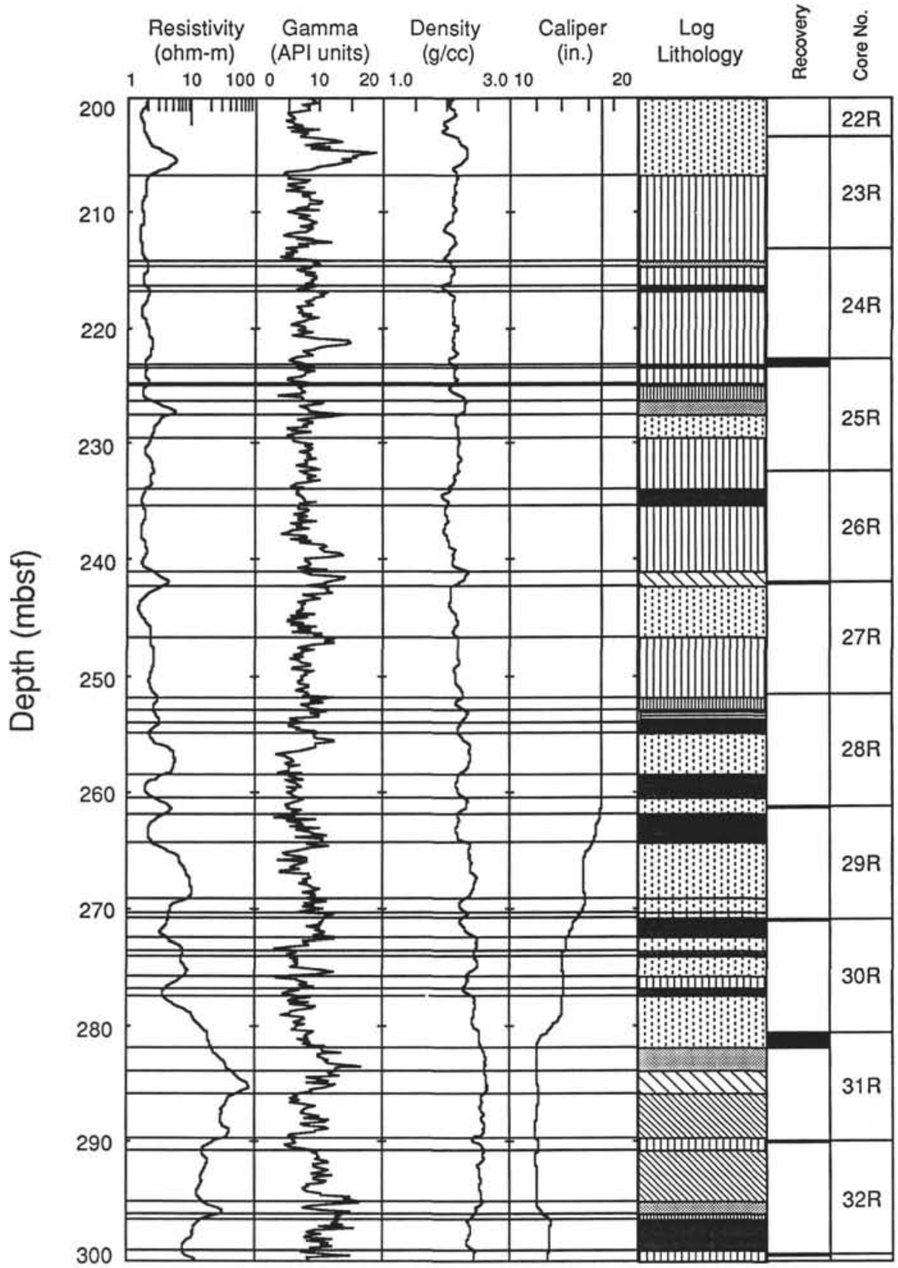
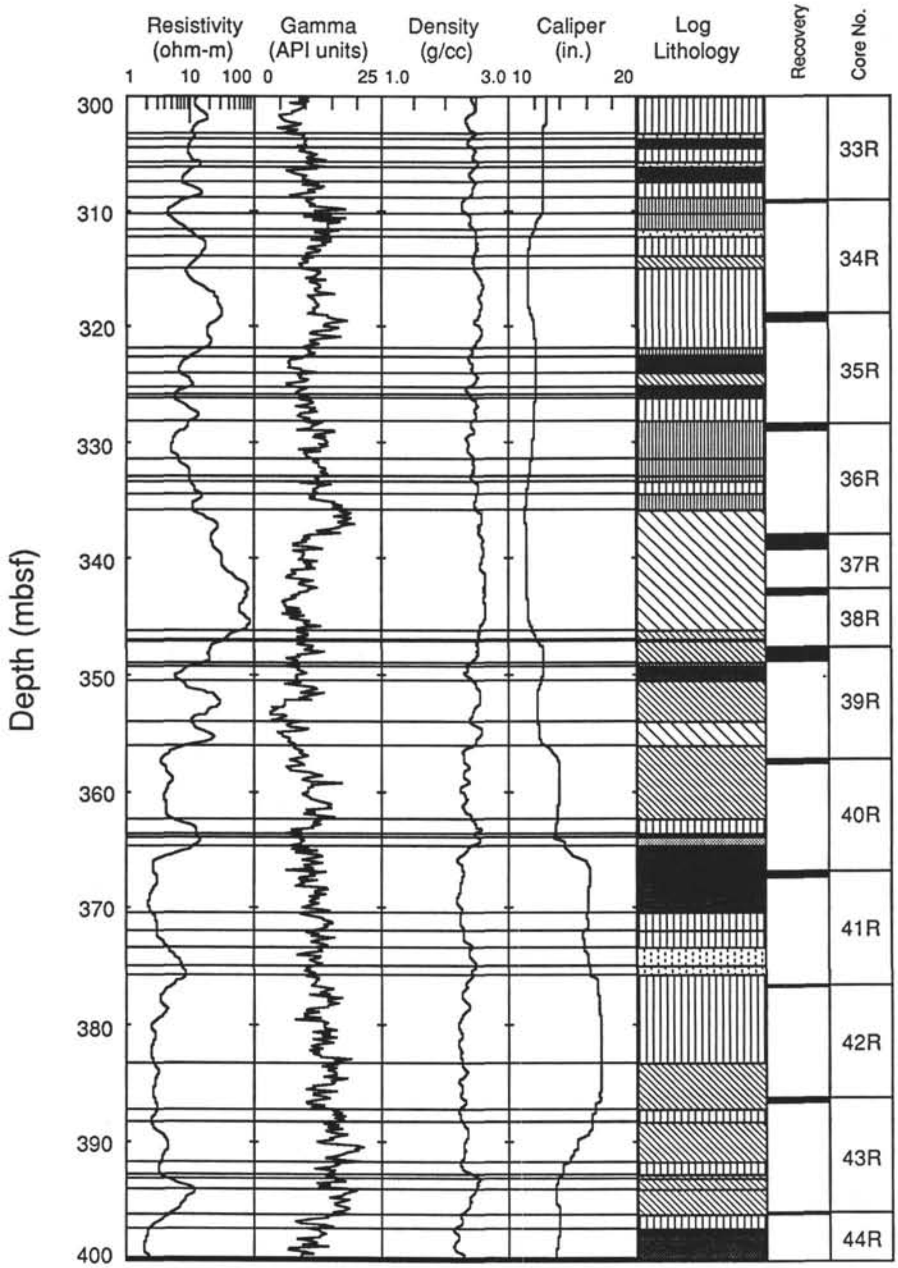


Figure 10. Profiles of (from left) medium electrical resistivity (ILM), natural gamma-ray intensity (NGT), formation density (RHOB), and caliper (HLDT), determined from downhole logs at Hole 866A. Cored intervals and recovery (in black) are shown in the right columns. The exact position of the cored material within the cored intervals is not constrained; recovered core material was pushed to the top of each cored interval for consistency. Also shown are lithologic interpretations based on integration of the FMS and geophysical logs with core descriptions; the pattern legend is shown in Figure 8.



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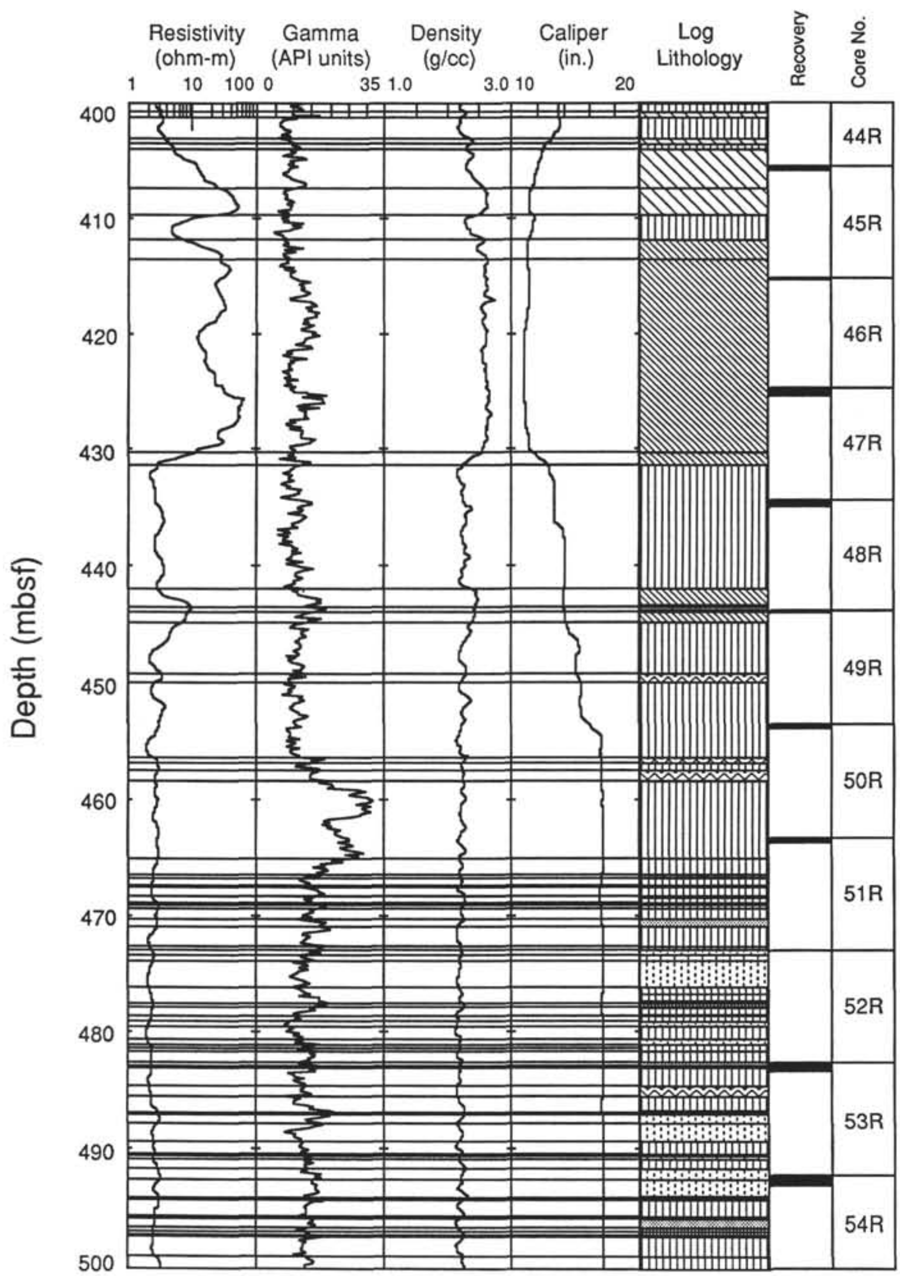

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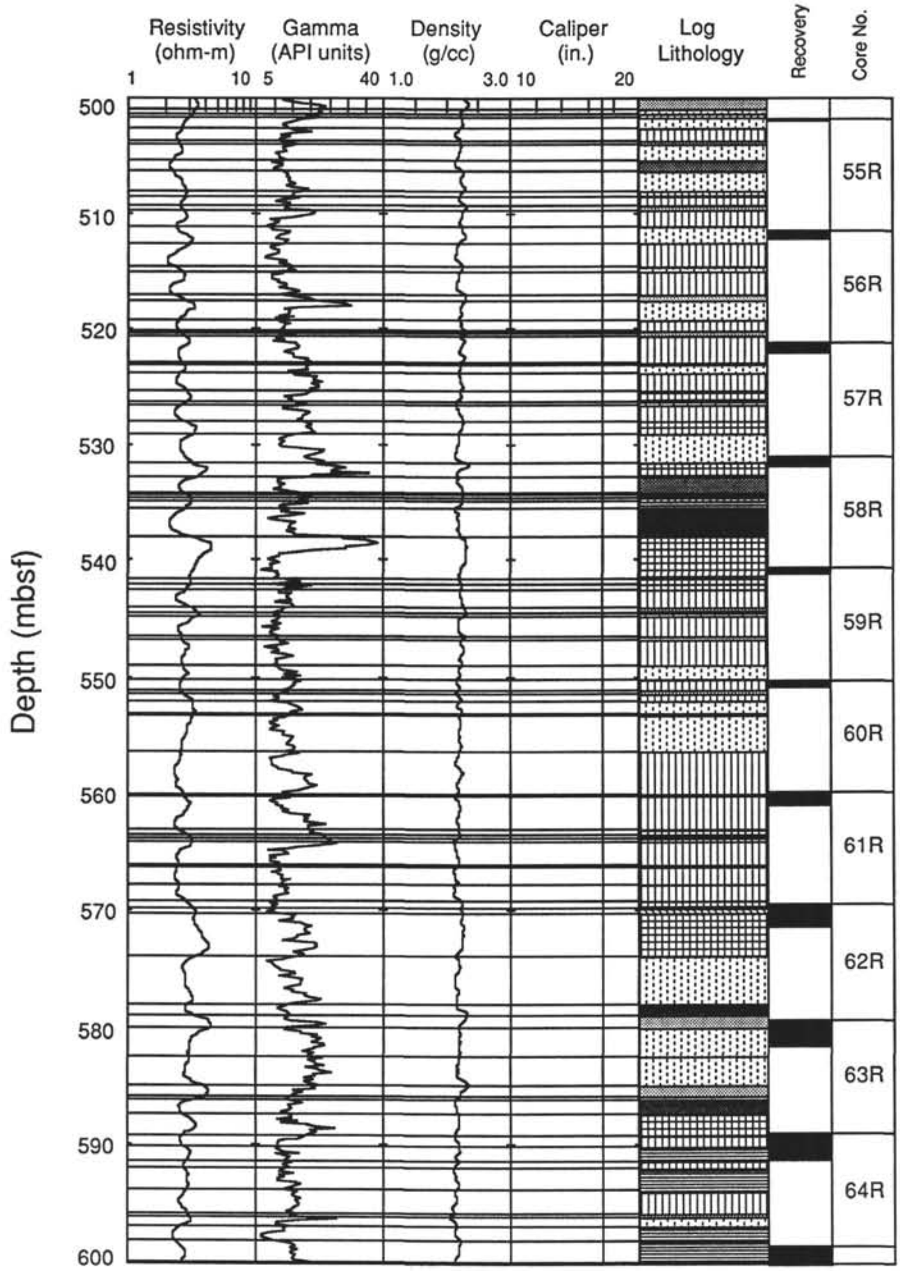

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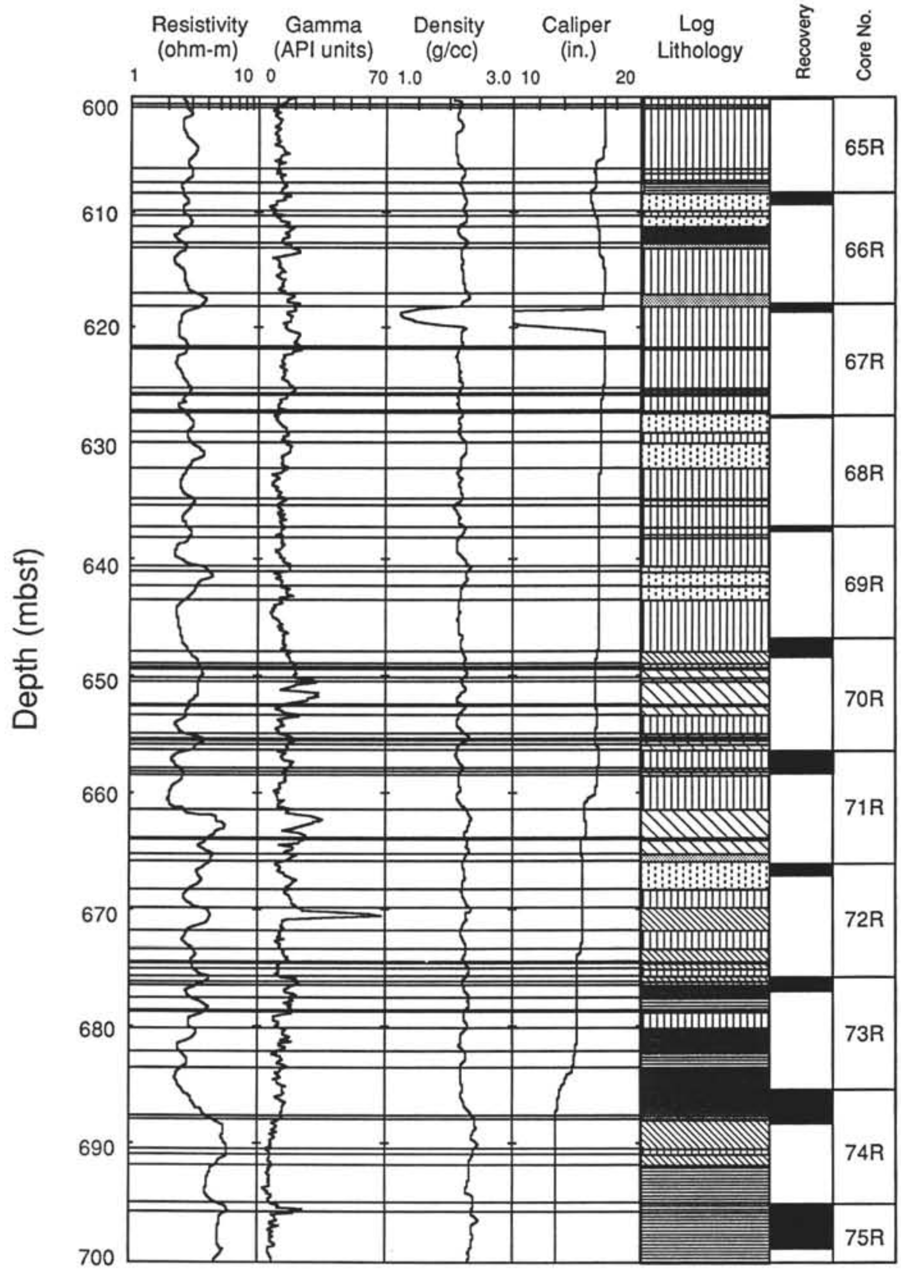

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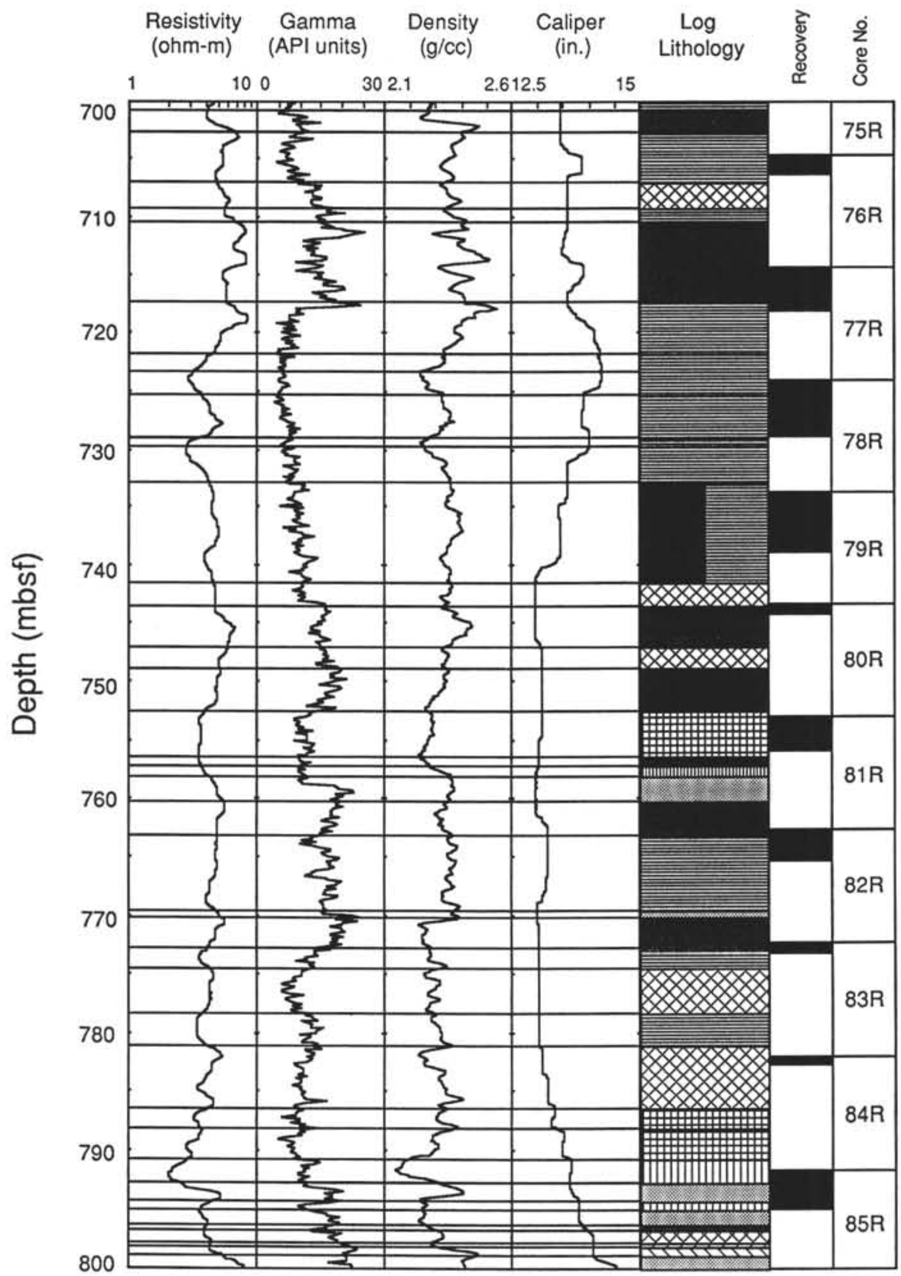

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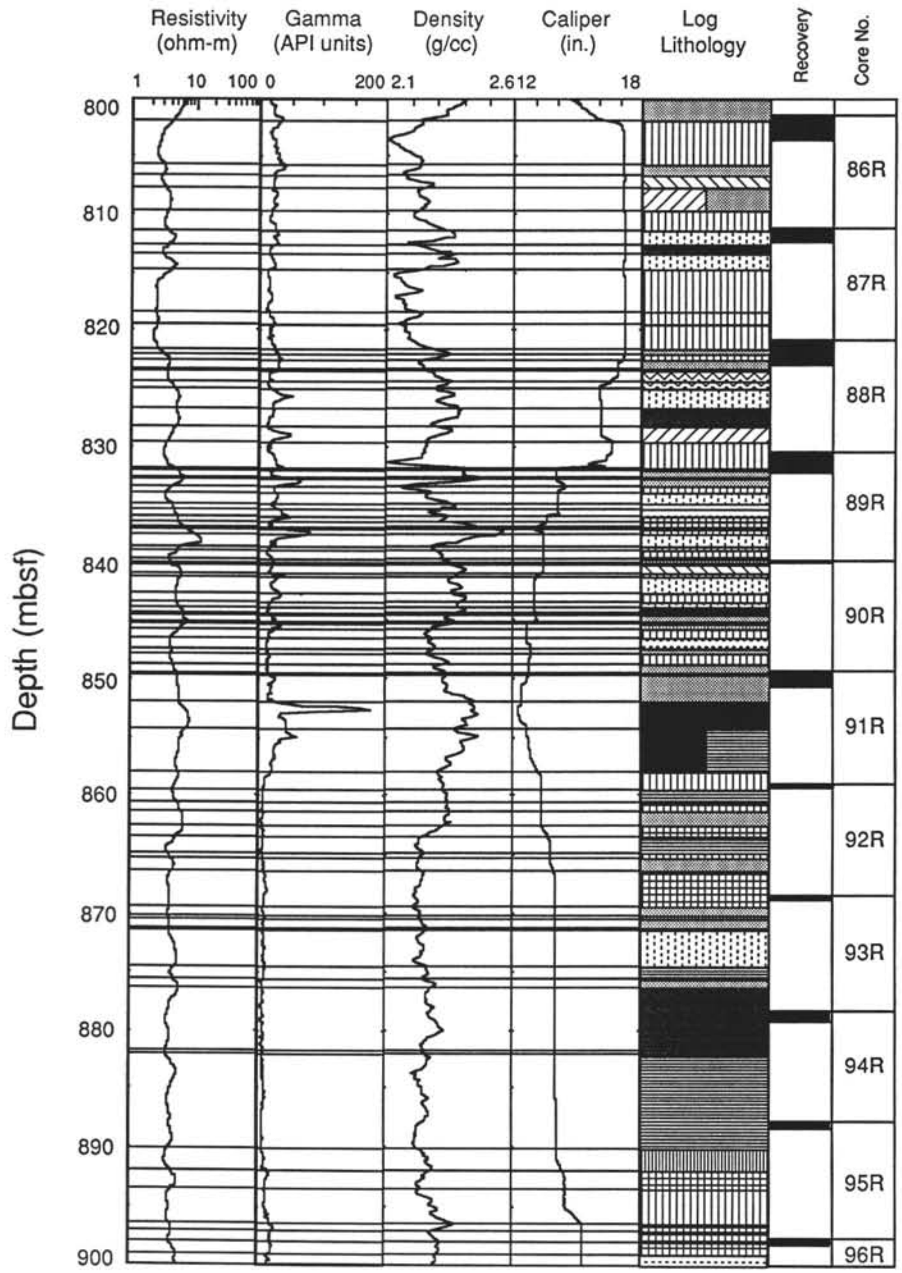

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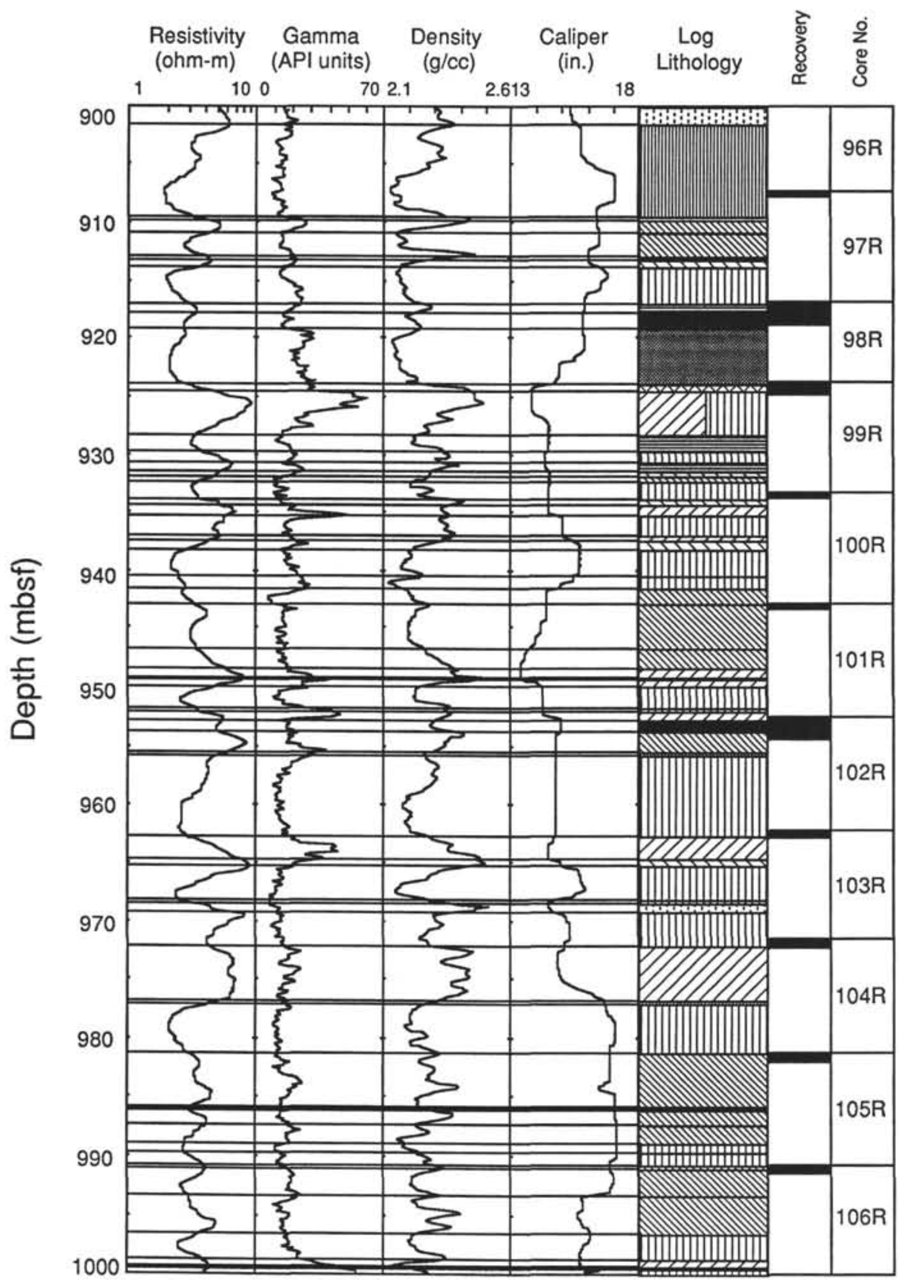

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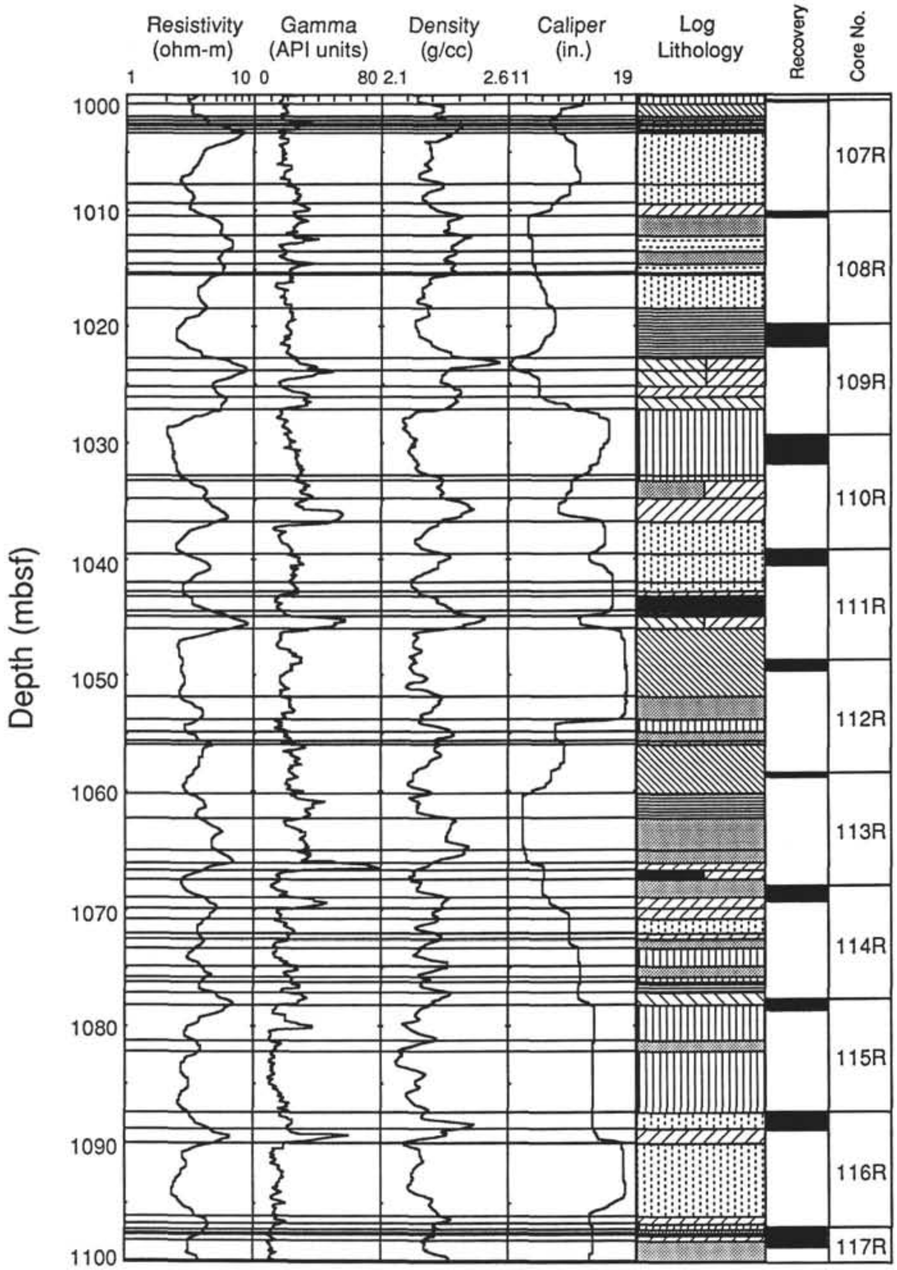

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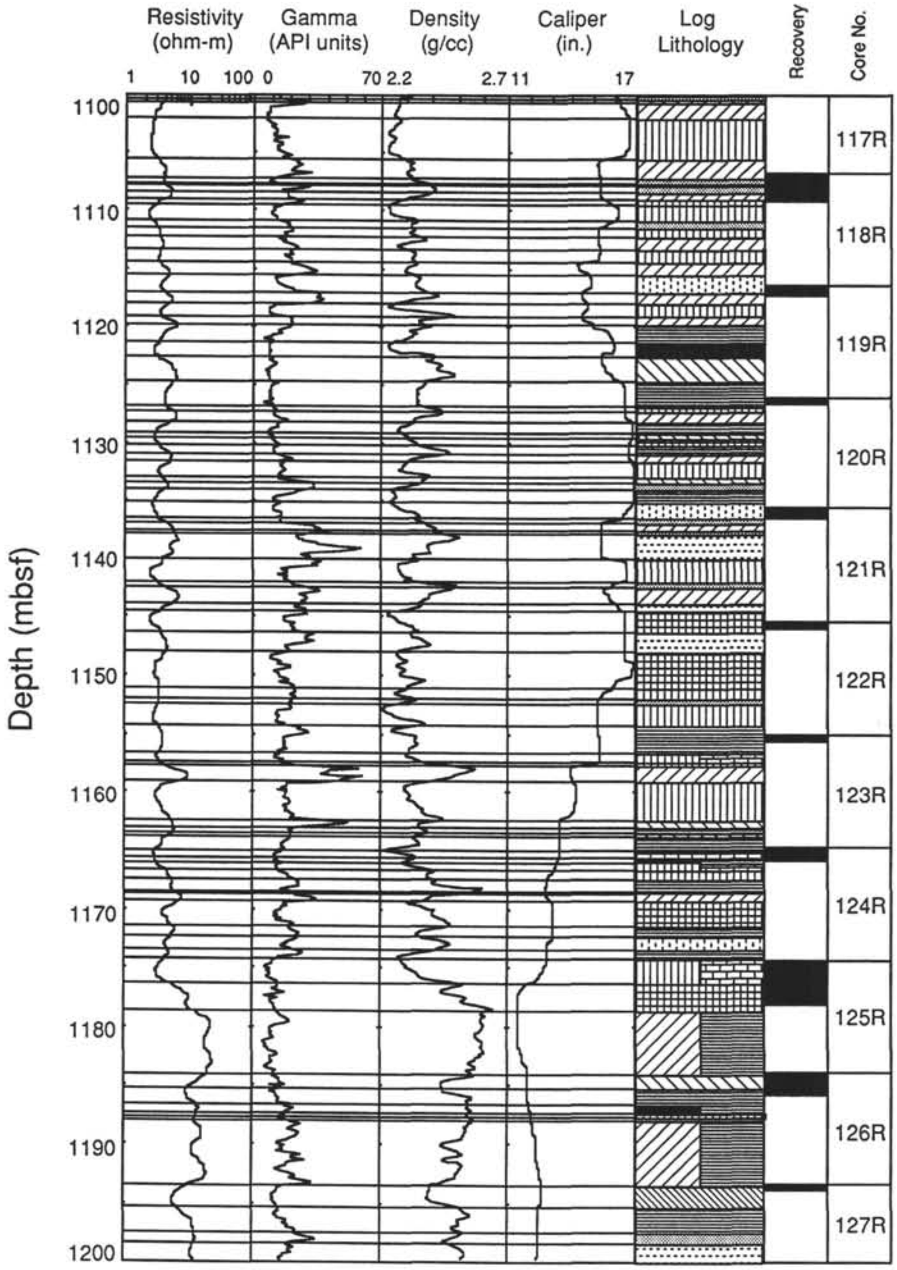

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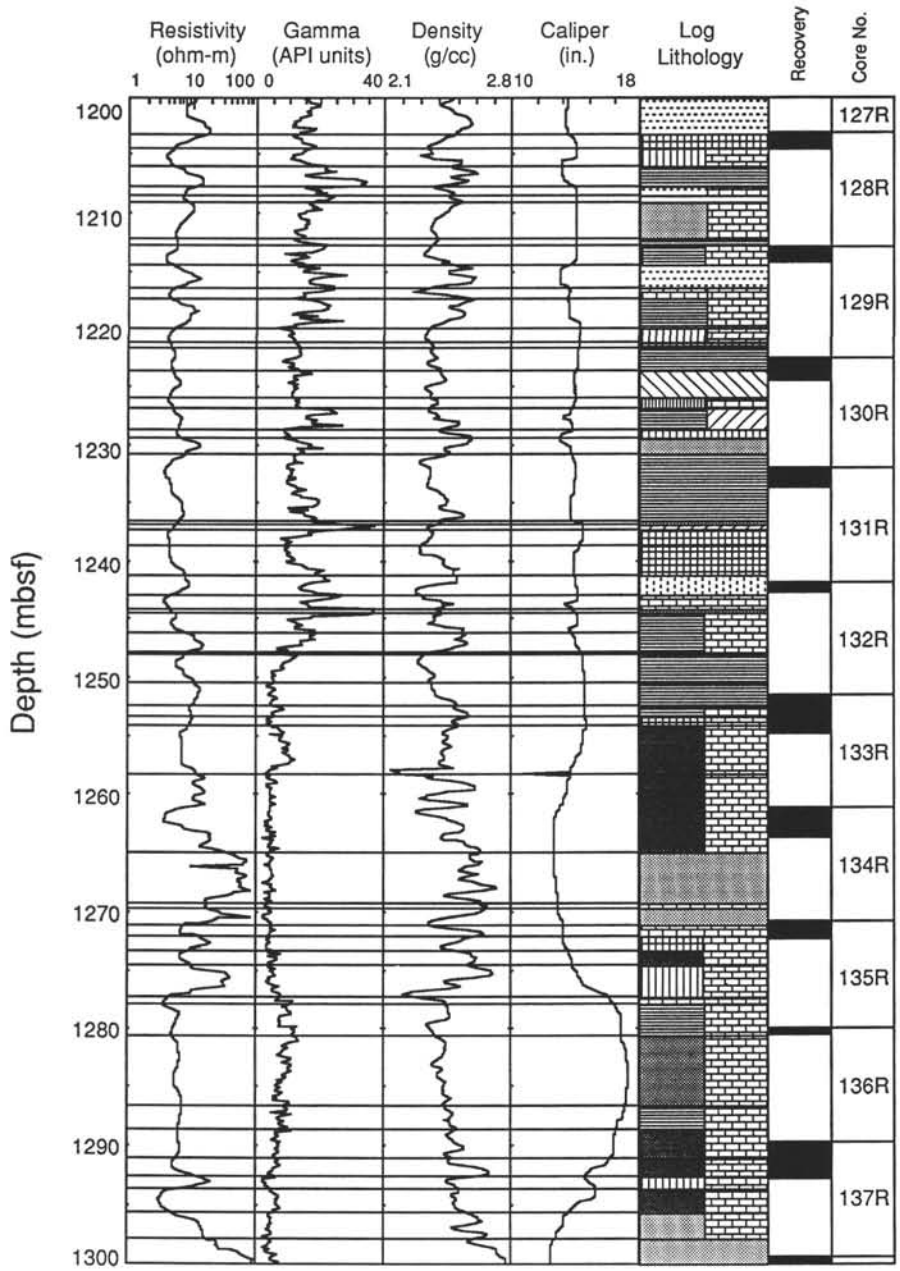

Figure 10 (continued).

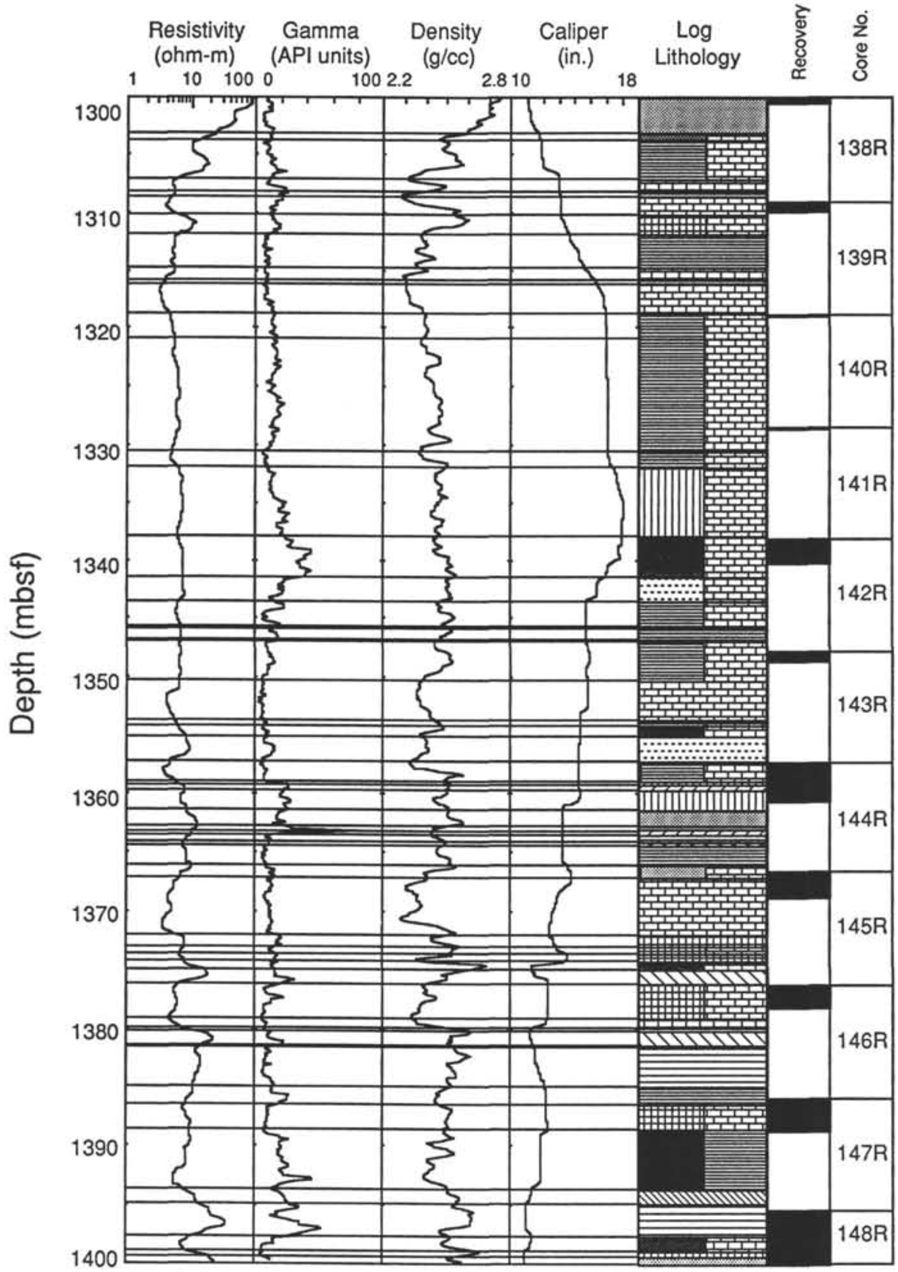

Figure 10 (continued).

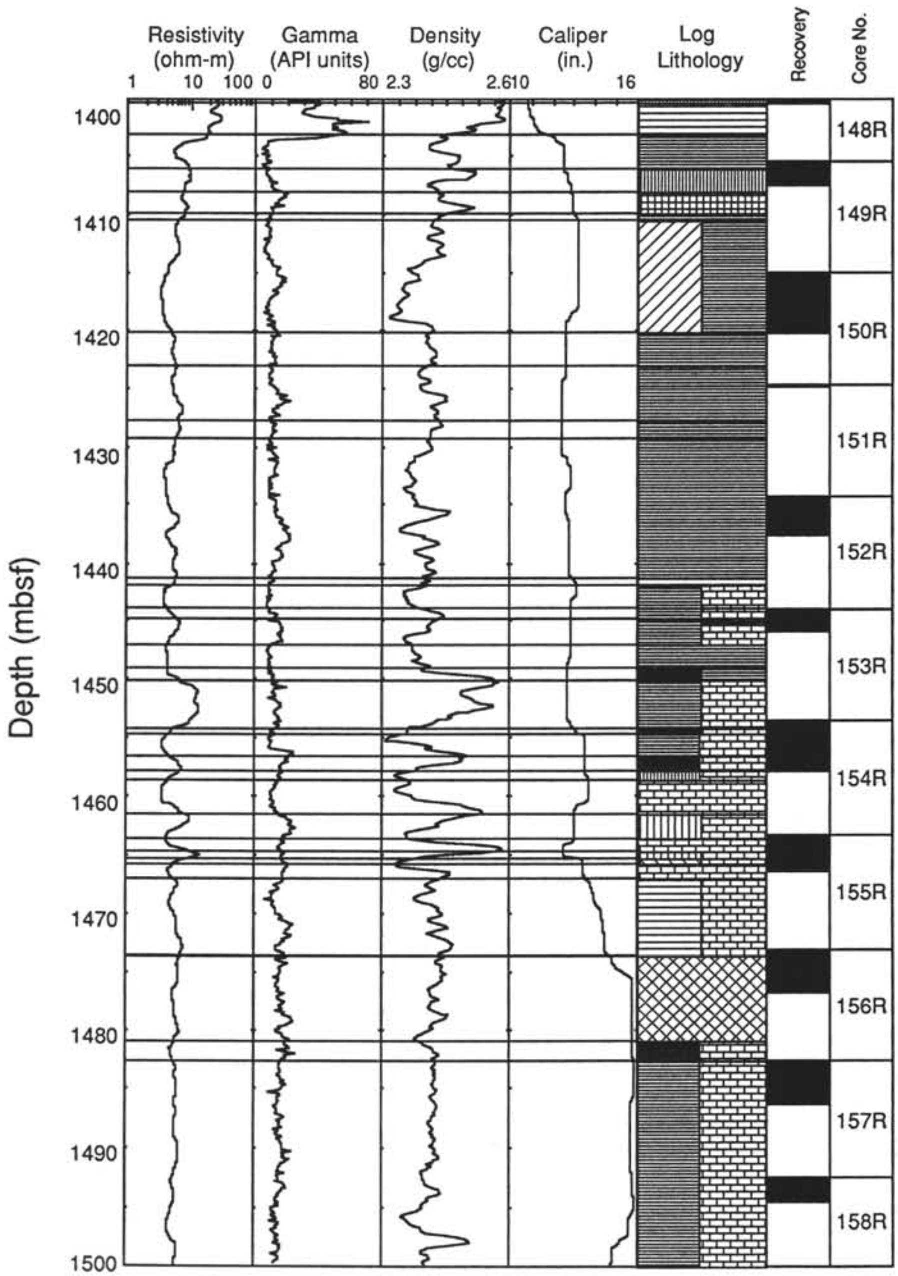

Figure 10 (continued).

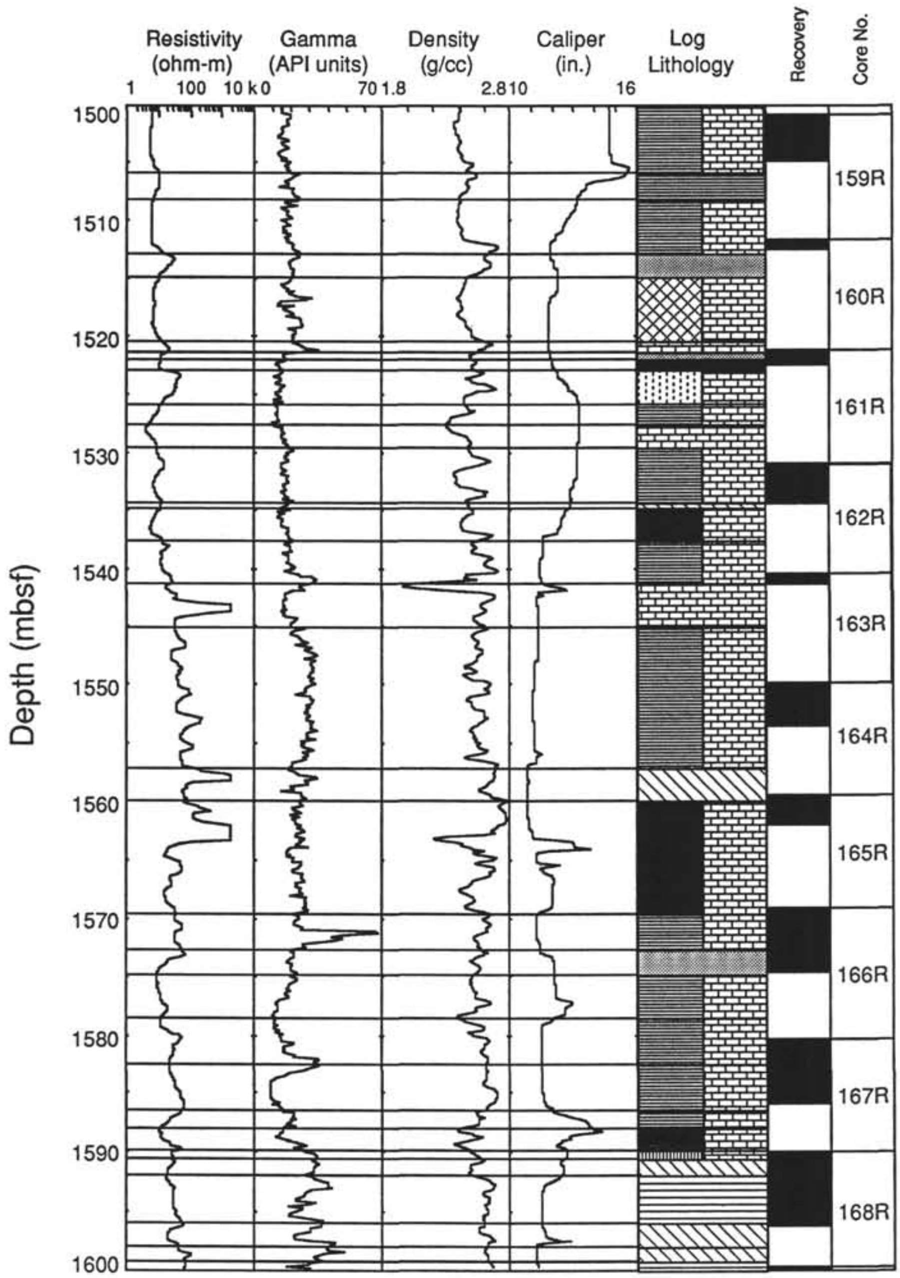

Figure 10 (continued).

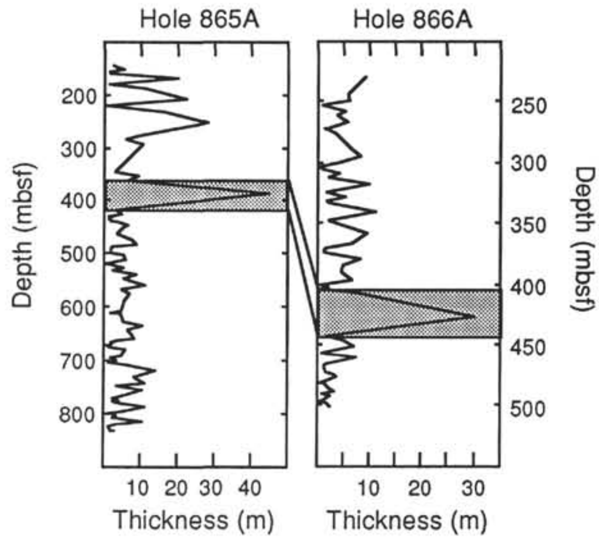

Figure 11. Comparison of upward-fining sequence thicknesses within the Albian portion of Hole 866A (top of logged section to 500 mbsf) and Hole 865A, which is entirely Albian in age.